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The Triumph of Arbitration.

The arbitration committees of the National Metal Trades Association and of the International Association of Machinists, after a session of more than a week at the Murray Hill Hotel in this city, reached a settlement on May 18 which is considered quite satisfactory to all concerned. Both committees agree that conflicts between capital and labor are disastrous to each, and that it is necessary to adopt just measures that will prevent future strikes or lockouts in the trade. The strikes at Paterson and Cleveland are declared off, and the employers there are directed to reinstate as many of their old men as the necessities require. This action was taken so that all former employees who may apply for reinstatement shall be given positions provided there are vacancies for them. Similar action is to be taken where strikes exist in factories the owners of which are not members of the National Metal Trades Association.

The committees pledge their respective organizations that if the employers or employees affected do not live up to the terms of the agreement the offending firm or union shall be reported for discipline, suspension or expulsion, as the merits of the case may justify. The qualifications of employees are to be determined by employers, but this fact does not abridge the right of the former to appeal from what may be considered an unjust decision. Extra pay is to be allowed for overtime. One apprentice for a shop and one for each five machinists is allowed.

Fifty-seven hours shall constitute a week's work from and after six months from the date of this agreement, and fifty-four hours after twelve months. In regard to the strike at Paterson, where a demand for an increase of 10 per cent. in wages was made and an advance of 7 per cent. was allowed, the joint conference decided that wages shall be increased 10 per cent. from the rates prevailing on December 19, 1899, when the demand was made. The resolutions adopted are to take effect immediately.

Not only the parties directly interested, but the entire nation is to be congratulated upon this happy averting of what might have been a most serious and disastrous struggle.

Forty-first Meeting of the American Society of Mechanical Engineers.

The meeting opened in accordance with the program, the evening of Tuesday, May 15, in the convention hall of the Grand Hotel, Cincinnati. The special features of the evening were the address of welcome by Mayor Tafel, and a response by President Morgan. The members had been arriving all day, a party of about forty coming from the East by one train over the Pennsylvania Railroad. After the speech-making the members adjourned to the dining-room floor, where an informal reception and dance were held.

WEDNESDAY MORNING SESSION.

A short business session preceded the reading of papers, features of which were the reading of a letter from Professor Thurston calling attention to the International Engineering Congress to be held in Paris this summer and the presentation of a report by Mr. Stanwood, chairman of the committee appointed to determine upon a set of standards for such features of direct-connected generating sets as are capable of standardization. The report was preliminary and tentative only—rather a report of progress than anything else; but it showed that the committee has made excellent progress. Both engine and dynamo builders have shown a highly commendable spirit of co-operation, and the committee has in consequence drawn up a set of proposed standards for speeds and armature bores. The report, although preliminary only, will be printed and distributed to the members in order to obtain their criticisms, and meanwhile the committee will continue its work in connection with dynamo bases, outboard bearings and other features coming within its province.

The Committee on Junior Meetings also made a report stating what had been done. A feature of the Junior meetings of the past winter was the preponderance of the older members in attendance, and the intention for the future is to recognize this fact and to endeavor to secure papers which shall be distinct contributions to the subjects treated. Every effort will be made to minimize, so far as possible, any sectional feature of the meetings.

Letters were read by the Secretary from Milwaukee, Wis., inviting the society to holds its spring meeting of 1901 in that city, and Mr. Rohrer presented the claims of Saratoga for that meeting.

The convention then proceeded to the reading and discussion of papers, the first one taken up being entitled:

Hot Water Heating From a Central Station.*

BY H. T. YARGAN.

This paper gives a very clear account of a system of hot water circulation for the heating of houses which is in actual use at two different points in the city of Toledo, Ohio, and in ten other cities and towns. The water in each case is heated by the exhaust from the engines of an electric light station, and is circulated back and forth through the circuit by a steam pump. Although a pressure of 60 or 70 pounds is maintained in the pipes, the water is not heated to the temperature which steam of that temperature would require, the temperature never rising above 212 degrees, and being carried considerably lower than that at times, according to the temperature of the air at the time. The system is said to be operated with en-

*Printed copies of all papers may be obtained at small cost by addressing the Secretary of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York.

tire satisfaction to the customers and with profit to the investors. The several advantages of this system of hot water heating over steam heating are enumerated at the end of the paper.

In the discussion Mr. Hewitt referred to the Evans-Almirall system of heating mills and factories, which is substantially the same system applied to an isolated plant. As a central station system he considered the tank of hot water, by which the heat of the surplus steam exhausted during the hours of heavy load is stored for use when the load becomes less, to be an impracticable feature on account of its size, and he presented some figures to substantiate his views. Mr. Waldron also took exception to some of the claims made for the system over that of the use of exhaust steam direct, and referred to the exhaust heating plant in use at the works of the Yale & Towne Manufacturing Company. Mr. Mattes pointed out the limitations of the system and thought the author had claimed altogether too much for it. He considered the public supply of fuel gas to be the final and ideal method of distributing heat, and remarked that while hot water will heat a house, it will not cook the dinner nor furnish power. He fully expected to see at least one pipe line from the anthracite region to the seaboard within the next five years, distributing such gas made from the culm banks, which are so prominent a feature of the anthracite country. Some of Mr. Mattes' remarks were decidedly witty, and "brought down the house."

In reply, the author claimed that Mr. Hewitt's deductions were erroneous, because his calculations were based on the entire heat of the exhaust at the time of the heavy load, the fact being that the storage tank had only to deal with the surplus above the average. In point of fact, the storage tank is not of impracticable size. He considered Mr. Waldron's comparison as beside the mark, because it was made between an isolated steam plant and a central station water plant. He also considered that Mr. Mattes had overestimated the possibilities of fuel gas quite as much as he had claimed the possibilities of hot water to be overestimated, and promised to present figures in his rejoinder, as published, to substantiate this position.

The next paper was entitled

Systems and Efficiency of Electric Transmission in Factories and Mills.

BY WILLIAM S. ALDRICH.

This paper discusses and compares the several different means of power transmission, electric, pneumatic and hydraulic, showing the field which each may properly occupy and showing also how much wider is the applicability of electricity than of all the others. Various systems of electric distribution are then spoken of and those best adapted to certain conditions are pointed out. Transmission by direct currents, by alternating currents, induction motors, synchronous motors, combined induction and synchronous motor working, and economies effected by electric transmission, are the titles of successive sections of the paper. A number of interesting and valuable diagrams run through the paper. The actual saving of power by the adoption of electric driving in a number of instances selected and enumerated at the end of the paper, render it eminently practical and valuable.

The discussion related mainly to the merits of the induction motor—its great simplicity and freedom from liability to accident with the absence of starting boxes and devices intended to open the circuit under over-loads, and the fact that it had no adjustments, and hence could not be tampered with.

One speaker, however, recalled the saying, "Save me from my friends," and said that while it is true that the induction motor itself is simple, its connections are the reverse, and instanced cases when these connections become formidable in extent.

The title of the next paper was

On the Value of a Horse-power.

BY GEORGE I. ROCKWOOD.

This paper, which was presented at the December meeting of the society, was brought up again at this meeting for the purpose of continuing the discussion which it so prolifically provokes. It has to do not so much with the actual value of a horse-power as with the proper method of computing that value. The author of the paper was an important participant in extended legal proceedings in which the city of Worcester, Mass., was engaged in consequence of its appropriating the waters of a certain stream upon which were some eighty operative water privileges. The total quantity of power lost was about 1,000 horse-power for eleven months of the year, and a settlement was effected by the payment of $500,000, with interest for four years. The legal expenses are not stated, but they must have been large, not only from the time occupied, but from the number of eminent and costly experts employed. These developed the most opposite opinions, and the cost of a horse-power is still eminently debatable.

The discussion showed that the author was unfortunate in the selection of the title to his paper.

Mr. Nagle pointed out that a foot could have no value until it was applied to some substance, and that the same was true of a pound, which being the case, neither their product, a foot pound, nor any number of foot pounds, nor a horse-power, could have any value as such. Mr. J. M. Smith considered the subject purely a commercial and legal one, and hence outside the province of the society, and he opposed the appointment of a committee to consider the subject on that account.

In his rejoinder, Mr. Rockwood thought that his critics had not read his paper. He had not discussed the value of a horse-power, but of a water-power privilege, which, as a piece of real estate, had a value. The courts are entirely at sea in determining such value and have appealed to engineers for aid. It appeared that the council had rejected the proposition for a committee for the reason given by Mr. Smith, and Mr. Rockwood contended with some warmth and, in the writer's mind, with success, that the commercial feature did not enter here any more largely than in many other questions which by common consent were properly within the scope of the society's labors. Mechanical engineering, he contended, is largely commercial, and the work of the committee which he advocates would be as much within the field of the society's work as that of the pipe flange committee, for example.

The concluding paper of the program for the evening was

On the Design of Speed Cones—A New Formula.

BY JAMES J. GUEST.

This paper gives a mathematical analysis of the speed-cone problem—the author stating that the necessity of laying out some speed cones where accuracy was important had called his attention to the fact that existing methods involved a considerable use of the trial-and-error method in order to obtain the exact speeds desired. The method here developed eliminates this feature and allows the desired sizes to be arrived at at once. The author develops his equations into converging series, of which but few terms are necessary for practical use. The equations are thus reduced to a manageable form and the method developed appears to be a practical one.

The author being absent and the paper quite mathematical, it was read by title only. Some written discussion of it, being of the same nature, was not read.

WEDNESDAY EVENING SESSION.

The first paper taken up at this session was entitled:

Reheaters in Multiple-Cylinder Engines.

BY R. H. THURSTON.

This paper opens with a short historical account of the use of steam reheaters in steam engines, and continues with a presentation of tests which have been made by different parties to determine the value of such reheaters. The opinions of various eminent engineers are also given. The author concludes that there is a real, though small, gain due to the use of reheaters, but he insists that "unless the reheater is made effective in superheating, it is best not to employ it at all, relying in such cases upon the separating apparatus."

In discussion, Mr. Rockwood agreed with the author that the steam should be dry on entering the reheater. He is now

(*Continued on page 505.*)

Commercial Review.

NEW YORK, SATURDAY EVENING,
May 19, 1900.

MACHINE TOOLS.

The favorable settlement of the difficulties between manufacturers and employees will be of incalculable value to the machinery business. A manufacturer identified with the National Metal Trades Association thus expressed himself as to the consequences of a general machinists' strike: "The engineers' strike in England was largely instrumental in losing for that country her supremacy in the world's markets, which it will probably take her a generation to regain. If we in America drift into a similar state of affairs we shall forfeit our commercial position in the same way, and the Germans probably will succeed to it. The interest of both parties in our industrial wrangle will be most seriously compromised unless the threatened outcome be averted."

Aside from the escape from this calamity, the healing of the wound tends to have a direct beneficial effect upon the machine tool market, because of restored confidence, which will stimulate in manufacturers a willingness to buy tools. It was a machinery manufacturer of some prominence who voiced this opinion in a conversation yesterday, and he enforced it by citing his own case. "Last week," said he, "I would not have bought a machine tool to add to my plant. Last night—such had been the prospects of a favorable outcome created in the meantime—I placed orders for two."

Some of the machinery manufacturers with whom conversations upon the labor question have been held have no hesitation in expressing themselves favorable to concessions in regard to hours of work. One who has taken prominent part in the manufacturers' organizations expresses himself substantially in this wise: "I am thinking of making an advance in the wages of my men when the disturbance is over, where I see that they have been faithful to me. I would not do it before a settlement was reached and stand a chance of having to make two advances. I have been advocating a shorter day among my fellow manufacturers and am planning to see how it may be accomplished in my own shop. It must be accomplished, if at all, by more economical methods of production, and I can see cases where improvements in this respect are possible. I am now preparing for the construction of certain special machines with this end in view."

The head of another machine plant—a tool building works where between 400 and 500 men are employed—remarked not long ago: "I would gladly turn over to nine hours' time to-morrow if other manufacturers would do the same." He avowed philanthropic motives for taking this position.

Among the work that is being figured upon in the local machine tool market is an order for a block of tools footing up to about $15,000, which are wanted for steel castings work in Pennsylvania. It is believed that this deal will be closed up next week. An order of some size is in prospect for a mining and railway plant in Asia, and there is in the wind an export contract amounting to several hundred thousand dollars.

A wood-working machinery dealer states that he is able to get goods from factory no quicker now than three months ago. He is paying high prices for second-hand machines and selling them up to within 10 per cent. of the price of new.

Bids on a horizontal bending machine for the Norfolk Navy Yard were opened May 15. The Hilles & Jones Company bid $13,170 and $13,920. The Niles Tool Works Company, $14,500. On a direct-connected electric generating set the bids were: McCay Engineering Company, Baltimore, $14,185, $14,340 and $15,785; the General Electric Company, $14,600; Thresher Electric Company, $15,000; Crocker-Wheeler Company, $17,077; Sprague Electric Company, $18,100.

MACHINERY OPPORTUNITIES IN GERMANY AND VICINITY.

The following are some more new enterprises selected and translated from the list of the "Deutsche Metall-Industrie Zeitung:" The "Frankfurter Eisenbau-Anstalt Rohnstadt & Zweigle," of Neu-Isenburg, Franfort, was proposing to erect at Dürnhof, in that region a plant for bridge and structural work. The firm "C. O. Dost & Co.," which had been occupying a machine shop in Magdeburg—Neustadt, Saxony, Prussia, founded in 1890, had changed its title to "C. O. Dost," and taken larger quarters in Magdeburg-Sudenburg. Here will be manufactured various kinds of metal-working machinery, etc. The firm "Pilgrim & von Königslöw," in Dortmund, Westphalia, Prussia, had a project for the manufacture of structural iron and sheet-metal work. The "Aktiengesellschaft Neptun," a shipyard and machine shop in Rostock, Mecklenburg-Schwerin, proposed to enlarge its works and to make a pneumatic riveter. Under the firm name "Kommanditgesellschaft L. Kainz," Herr L. Kainz, formerly technical manager of the machine shop, "Tanner, Laetsch & Co.," in Penzing, near Vienna, Austria, was erecting a large machine shop in Liesing, near Vienna. The "Lüneburger Eisenwerk," in Lüneburg, Hanover, Prussia, was planning for important improvements. Part of the steel works of the "Friedenshütte," in Upper Silesia, had been destroyed by fire. The "Maschinenbau-Aktien-Gesellschaft 'Vulcan,'" Stettin, Prussia, had increased its capital. It was proposed also to increase the capital of the "Zahnräderfabrik Augsburg, vorm. Joh. Renk," a gear-wheel factory in Augsburg, Bavaria, partly for making extensions, and of the "Dampfkessel und Gasometerfabrik vorm. A. Wilke & Co.," Brunswick, Germany, a steam boiler and gasometer factory.

The Germans have stolen a march upon the Americans in Porto Rican trade in the last year by exporting printing presses and machinery to that island.

FRENCH INVITATION TO AMERICAN COAL CUTTERS.

Some attention on the part of French coal mining engineers is being attracted to American coal cutters, including pick, cutter bar, chain breast and long wall machines. "Why are not these machines adopted in France?" asks the "Chronique Industrielle." "It seems that a thorough trial ought to be given to the new devices which yield such beautiful results in America. Thus would be avoided the most painful part of the miner's work. Ought it not to be the engineer's object to accomplish by machinery that which is unduly arduous or repugnant, the machines being supervised by intelligent men?"

MACHINERY INDUSTRIES IN TURKEY.

The industries of Turkey depend upon imported iron. The most important technical undertaking is the Central naval arsenal in Constantinople. Besides docks for shipbuilding and repair, there are boiler, torpedo and cordage works, a foundry, smith shop, repair shop, etc., employing some 3,000 men. What has been accomplished in this establishment is, however, very small compared with all the money, time and labor expended. For example, the ship "Hamidieh" has been twenty years in building. The Imperial docks are used chiefly for small repairs. Other metal-working stablishments at Constantinople that may be mentioned are the cannon foundry in Tophana, where there is also a factory for Mauser rifles, a type foundry in Stamboul, a lead pipe works in Galata, and several small workshops.

MACHINERY EXPORTS FOR MARCH.

The "Monthly Summary of Commerce and Finance," compiled by the Bureau of Statistics, United States Treasury Department, for March, 1900, shows a good valuation of metal-working machinery shipments, so far as officially reported. For that month it amounted to $703,460, as compared with $638,664 for March, 1899, and $585,854 for February, 1900. For the nine months of the present fiscal year, from July 1, 1899, to April 1, 1900, it aggregated $5,389,444; for the corresponding portion of the last fiscal year, $4,832,569.

Electrical machinery exports were: March, 1900, $473,119; March, 1899, $254,092; February, 1900, $291,678; present fiscal year to April 1, $2,906,031; last ditto, $2,080,739.

Pumps and pumping machinery: March, 1900, $303,842; March, 1899, $333,006; February, 1900, $241,393; present fiscal

year to April 1, $2,351,060; last ditto, $1,974,007.

Stationary steam engines: March, 1900, 82 in number, at $43,324 aggregate value; March, 1899, 38, at $19,222; February, 1900, 108, at $33,953; present fiscal year to April 1, 821, at $463,337; last ditto, 357, at $214,431.

Locomotive engines: March, 1900, 62 in number, at $605,509 aggregate value; March, 1899, 30, at $254,032; February, 1900, 39, at $386,765; present fiscal year to April 1, 394, at $4,095,534; last ditto, 372, at $3,432,674.

Boilers and parts of steam engines: March, 1900, $98,949; March, 1899, $81,508; February, 1900, $80,615; present fiscal year to April 1, $1,235,906; last ditto, $865,497.

Typewriting machines and parts thereof: March, 1900, $272,447; March, 1899, $309,611; February, 1900, $213,156; present fiscal year to April 1, $1,998,589; last ditto, $1,684,079.

Sewing machines and parts thereof: March, 1900, $426,209; March, 1899, $400,780; February, 1900, $345,272; present fiscal year to April 1, $3,328,348; last ditto, $2,282,333.

Cash registers: March, 1900, $68,221; February, 1900, $60,346; present fiscal year to April 1, $613,269.

Printing presses and parts thereof: March, 1900, $107,287; March, 1899, $127,259; February, 1900, $113,176; present fiscal year to April 1, $912,301; last ditto, $589,251.

CHICAGO MACHINERY MARKET.

That department of the machinists' supplies trade which goes directly to the mechanic is reported to be in an excellent condition. The machinist has more money to spend than a year ago; much more than he had two years ago. If he is a machinist at heart, he takes pride in his kit of tools, and there are a number of improved tools which he always has in mind to purchase when he feels that he can afford it. Conditions have been propitious for many months, but the trade is now as good as at any previous time in a long while. The machinists' strike seems to be out of sight, and the men are earning good wages.

When the purchases of the employers are considered, some modifications will have to be made to the statement that trade is good. It is good, but with several qualifications attached. In some directions, as among the foundrymen, there remain various labor troubles, which clog operations quite seriously. The local strike among the core makers is at this writing unsettled, but there are indications that within a few days the men will return to work. Then, again, the chill which went through all interests involved in the iron and steel trades five or six weeks ago, when wire took its sensational tumble, has not been followed by complete recovery. In fact, the tenor of buying seemed to take from that moment a decided change. Purchases for stocking purposes stopped almost instantly, and a hand-to-mouth system took its place. Many manufacturing interests say they are doing practically the same amount of business, but that it is composed mainly of little dribbling orders, which increases the clerical work in their offices three-fold. There is steadiness to these orders, which betokens a steady demand at consuming plants. The possible good of this situation is that the trade may be compelled to buy in this way all summer, whereas they had previously bought in the spring for their summer needs. The common report is that the aggregate trade shows a slight reduction. One or two sellers say it begins to look like summer dullness with them, but that experience is not the common one. There are a fair number of inquiries from new enterprises.

The W. A. Jones Foundry and Machine Company reports inquiries for several large rope drive outfits. Both machine shop and foundry are running full, and the men are invited to work overtime. The Armstrong Bros. Tool Company is running up to its full limit, and has enjoyed a large foreign trade recently. Brown & Sharpe Manufacturing Company has an excellent trade with dealers and is taking orders constantly for its large machines.

Hill, Clarke & Co. have made an innovation on Canal street by equipping the basement of their salesrooms with a large gasoline engine and shafting. They will show new machines in actual operation.

CINCINNATI REPORT.

This has been engineers' week in Cincinnati. There have been members of the craft here from all over the country, attracted particularly by the convention. Among the men of affairs who have been here this week was Mr. James Madison Andrews, assistant general manager of the power and mining department at the General Electric Company's works at Schenectady, N. Y. Mr. Andrews reports that mining operations suspended temporarily in South Africa on account of the Boer war promise to be resumed now in a few weeks. The General Electric Company is claimed to furnish at least two-thirds of the electrical machinery in use there, which has displaced that of English make, which had the call until recently.

Cincinnati is one of the largest centers in the world for founders' supply business. Reports from foreign countries through representatives of Cincinnati concerns now traveling there go plainly to show how extensive this trade is. The S. Obermayer Company is going after this foreign business in earnest, and a representative of the company has just left on a trip that will take him through England, Germany, France, Italy, Sweden, and other countries. His business will be to see and sell foundry supplies to the consumer direct.

A little labor flurry among the large boiler-making concerns in this vicinity is blowing over. An agreement has just been reached between striking boiler makers and other mechanics in the works of the Stirling Company, at Barberton and the officials of the company, which has resulted in the men going to work. An amicable arrangement was brought about largely through the good management of Secretary of the State Board of Arbitration Joseph Bishop, of Columbus, who was at Barberton several days looking after the strike.

Among the machine tool men there is evidence that the business will continue on a satisfactory footing through the summer. Representatives of a number of the larger concerns are in Europe, several looking after their personal interests at the Paris Exposition, and others making extensive tours among the trade centers. Phil C. Fosdick, of the Fosdick & Holloway Machine Tool Company, has just reached home from a six-weeks' trip abroad. Mr. Fosdick's trip was purely one of business. It took him to points in England, Scotland, Germany, France and Austria. He established a number of foreign agencies. The European demand for machine tools seemed to him quite as strong as it has ever been, and in some districts far greater.

Quotations.

NEW YORK, Monday, May 21, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$21 50 @ $22 00
No. 2 X foundry	20 50 @ 21 00
No. 2 plain	18 75 @ 19 50
Alabama Irons:	
No. 1 foundry	22 25 @ 22 75
No. 2 foundry	21 25 @ 21 75
No. 3 foundry	20 25 @ 20 75
No. 1 soft	22 25 @ 22 75
No. 2 soft	21 25 @ 21 75
Foundry forge	19 50 @ 20 00

Bar Iron — Base sizes—Mill prices on dock are 1.85 @ 1.90c. for good refined brands; store prices, 2.30 @ 2.40c.

Tool Steel—Base sizes—Standard quality, 6½ @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel — Base sizes — From store, 2½c. upward, unless in exceptional cases.

Cold Rolled Steel Shafting—Base sizes—From store, 3¾ @ 4c.

Copper—In carloads—Lake Superior ingot, 16¾c.; electrolytic, 16⅝c.; casting, 16½ @ 16⅝c.

Pig Tin—In 5 and 10-ton lots, 29⅞ @ 30c., f. o. b., New York.

Pig Lead—4c. in wholesale lots, carloads .02½ @ .05c. extra.

Spelter—Prime Western, 4.50 @ 4.60c., New York delivery.

Antimony — Cookson's, 10¾ @ 11c.; Hallett's, 9⅝c.

Lard Oil—Prime City, 58c. in lots of 1 to 5 barrels.

Origin of the Turret, or Revolving Head.

BY E. G. PARKHURST.

It may, or may not, be a matter of any public consequence who the inventor of the revolving turret head for screw machines was. If, however, it be considered of sufficient importance to be mentioned even casually, as in an article in the "Engineering Magazine," November, 1899, it may as well be stated correctly as incorrectly.

Mr. H. D. Stone was not the inventor of the turret, neither did he (if the patent records be correct) take out patents on a turret machine in 1857, 1858, 1859 or 1860. The only one recorded for him is dated August 13, 1874, which in no way concerns a turret, except in adapting a feed through belt and worm gearing action, to the slide of a screw machine on which a turret is mounted.

Previous to 1853, Mr. J. D. Alvord, then a contractor at Sharp's rifle factory in Hartford, Conn. (who afterwards installed the Wheeler & Wilson Sewing Machine Company's plant at Bridgeport, Conn.) made plans for a turret head screw machine. A little later these were improved upon by Mr. Fred W. Howe, who at that time was superintendent for the Robbins & Lawrence Company, at Windsor, Vt. No one man in America during his lifetime did more to perfect metal-cutting machinery than did Mr. Howe.

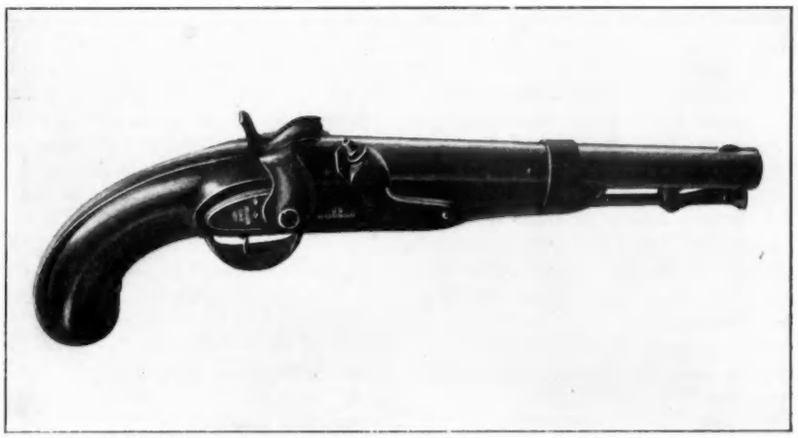
The Howe screw machine must have been designed somewhere between 1856 and 1858. In 1860 I was shown one by Mr. Howe himself, and am positive that I saw stamped on it "Designed by F. W. Howe, and manufactured by Robbins & Lawrence, Windsor, Vt.," which firm put them on the market later. In 1859 revolving heads were in use at the Colt Patent Fire Arms Company's, at Hartford, supposed to have been designed by Mr. Lorrin Ballou, then one of the superintendents at the Colt works.

There were also plans and patterns made for turret head machines at the Stroud Works, Middletown, Conn., in 1857, the machine being in operation in 1858. In 1861 there were made at the above mentioned works some twenty-five machines, though I will add that the Howe pattern was pretty thoroughly copied.

About 1861 the justly celebrated Brown & Sharpe Company, of Providence, R. I., took up the manufacture of the Howe pattern. Mr. Joseph Brown soon added to it the self-revolving turret, through ratchet and pawl action by the return motion of slide, and later a feeding device whereby a rod of metal could be fed forward and secured without stopping the machine. Mr. Brown was the first to adapt the above named appliances to the Howe machine, though by no means the first in the field with self-revolving of the turret, or feeding and securing rods without stopping the spindle of a machine, as both these had been accomplished several years prior to 1860.

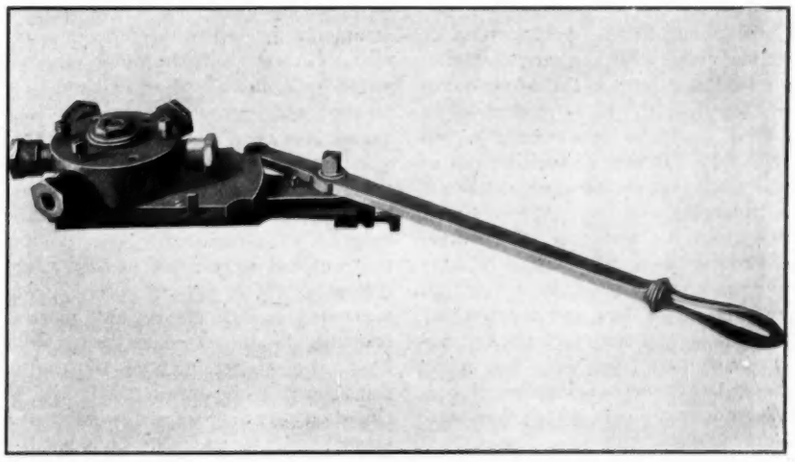
In 1861 Mr. F. A. Pratt and Mr. Amos Whitney (afterwards the Pratt & Whitney Company), of Hartford, Conn., took up the manufacture of the turret head screw machines, not the Howe pattern, but one of their own, which embodied the feature of a self-revolving turret. In this particular matter they antedate Mr. Brown's device. Many machines were made and put on the market from 1861 to 1870, when the old patterns were retired, and departures made which have since rendered them of world-wide reputation. At the Pratt & Whitney Company's works in 1869 two or three men were able to fill all orders on that class of machinery; today those employed number nearer two hundred. They have in all about 150 varieties, and the numbers manufactured have gone well up into the thousands.

During the period between 1852 and 1862 there were a number of eminent mechanics who almost revolutionized the mechanical world, by bringing nearer a state of perfection machinery for metal cutting, whose action could be depended upon for turning out work with precision. Many of these men have passed over the Broad River. Perhaps it would be of interest to some to know the names of those whose life labor was, and is, to perfect labor-saving machinery, and I believe it may be said that all of them, at some time, daily labored at the bench, from which, through their own exertions and native genius, they rose to fill the highest attainable positions in the mechanical world. The names of the gentlemen referred to as pioneers are E. K. Root, Sam. Batchellor, Lorrin Ballou, J. D. Alvord, R. S. Lawrence, F. W. Howe, F. A. Pratt, Amos Whitney, Charles E. Billings. All the above named brought out many new machines, which need not here be mentioned, during the period referred to, and all of them had a hand in either designing or manufacturing the revolving head screw machine.



THE ASHTON PISTOL—MODEL OF 1845.

Concerning the antiquity of the turret or revolving head for screw machines, I believe the facts in the premises warrant the assertion that one was made and used in 1845, and from that time until 1853 was in almost daily operation. In order that the reader may fully understand where the machine was made and what it was contrived for, I will give a history of the works where it originated.



THE BILLINGS TURRET AND SLIDE—1860.

In the year 1843 one Mr. Henry Ashton, of Middletown, Conn., a man of shrewd

mechanical ability and an excellent workman, conceived the idea of placing a percussion lock (now obsolete) on the United States Service army horse pistol. At that period all service arms, both muskets and pistols, were flint-locked. Mr. Ashton, with his own hands, made a model percussion lock pistol, took it to Washington, and brought it to the attention of the then Secretary of War, who was so pleased with the model that he gave a contract for thirty thousand of them. Mr. Ashton came home with his contract and formed a copartnership with five other excellent workmen, like himself, whose names were Sylvester Bailey, P. H. Ashton, John North, Nelson Ashton and Ira N. Johnson. Each man put into the company one thousand dollars for a start capital, and on the strength of the contract the Middletown banks loaned them on their joint note money enough to prosecute their business until such time as they could turn in arms to the Government.

They selected a mill site having suitable water power at Middlefield, Conn. (now Rock Fall), then about four miles from any railway and off the carriage road, in the woods, under a hill; in fact, the buildings would not attract the attention of anyone traveling the main road, as from it nothing could be seen except a few chimney tops. It was in such an out of the way place that six excellent mechanics banded together, and their followers were selected from the workmen at the other three armories then in operation in other parts of the town. In the beginning they had to construct a dam and water wheel, erect buildings and construct machinery—for the most part from their own plans. In twenty-two months from date of contract five hundred pistols were delivered to the Government.

All parts of the arm were made by contract, and one Stephen Fitch, a genius, contracted to make the thirty thousand cones, and after signing papers to that effect he afterwards made, at his own expense, a self-revolving turret head screw machine, which from 1845 to 1853, as before stated, turned out excellent work.

Therefore, in consideration of all the facts in the case, it is but justice to the memory of Stephen Fitch to award to him the honor of being the originator of one of the greatest labor-saving machines ever invented.

At the time the Fitch machine made its appearance there was little or no demand for gun screws machined from the rod; none were used on Government contracts for arms, as those in control of ordnance matters flatly refused (said the threads would not hold) to take any except those forged from the rod. It was not until about 1862 that the army officials would consent to even consider the matter of using the turret head screw machines in Government armories.

OLD METHOD OF SCREW MAKING.

Gun screws were forged from the rod (Norway iron) under what was called a jumper, an upright frame secured in anvil block, in which were dies, one above the other, having an imprint in the face of each, counterpart of the screw to be forged, and cut off in individual lengths.

The hand apparatus for machining consisted of a wooden bench on which was mounted a flat bed in the form of a quadrant. Central from the outer circle was pivoted a jointed stand and mounted so as to slip easily through same was a shaft having at one end a hand crank, at the other a compensating clamp (in form of nippers) to secure and rotate the screw blank either by the head or body, as the two operations were required. Near the outer circle of bed were fixed, usually at equal distances, three upright frames, which controlled in such manner two dies each, one fast, the other to open up for milling head; also one set for body and the third for threading the screw. All dies were closed on adjusting screws by weights, and opened up by foot pedals. Thus good, satisfactory work was accomplished, particularly in screw-thread size, as the cutting die controlled rather than the clamp on crank shaft, which had plenty of latitude in the before mentioned jointed stand.

AN EARLY AUTOMATIC SCREW MACHINE.

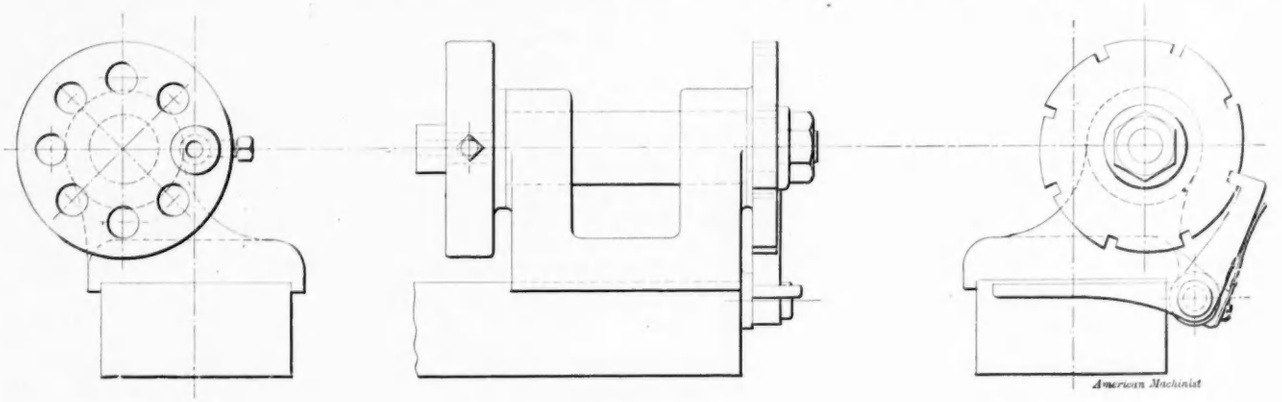
The first automatic screw machine we have knowledge of (not of the turret order) completed the screw, even to the nicking. It was devised by one Newell North, of Middletown, Conn., about 1848. It was several years undergoing experiments, and was finished in 1852 and successfully operated. There being no demand for its product, it was stored, about a year after which time it was destroyed by fire.

In 1874 N. C. Hubbell purchased from the Pratt & Whitney Company, of Hartford, a wire feed screw machine, and attached thereto an apparatus whereby the screws were threaded and nicked; in fact, it made what would be termed a finished screw from the rod. There were no distinctive alterations made on the machine, other than turning turret and slide for same up sidewise. Both turret and wire feed were operated by hand. Nothing of importance came of the arrangement (which operated fairly well), except it might be said that it was a connecting link between the hand and full automatic.

AUTOMATIC MACHINE.

The next one to take a hand was a man to whom your readers need no particular introduction—C. M. Spencer, second to none of American inventors. In 1880 he converted the Pratt & Whitney wire feed screw machine, pure and simple, into an automatic, by a central shaft, cams and levers, so that no hand operations were required other than to supply the rod from which the screw was made. Thousands of the machines are now in daily use for making screws and other articles too numerous to mention here. Mr. Spencer was the pioneer who opened up a field of vast magnitude, how vast one can determine by visiting any of the well-known establishments; for instance, the Hartford Screw Company. Since 1880 Mr. Spencer has brought out several automatic screw machines that in the way of production fairly eclipse his first effort, and his last—a very efficient one—strange to say, embodies the Fitch principle of the turret.

Since 1888 many skillful mechanics have brought out a variety of newly arranged machines. One has only to turn to patent records to find how many. The supposable reason for the lack of invention between 1880 and 1888 was the difficulty in



THE FITCH TURRET HEAD—1845.

obtaining a reliable rod feeding and holding device, such as that now in general use, which was held under patents the lapse of which, in 1888 (as was aptly stated not long ago by an eminent mechanical engineer), opened the doors wide and allowed inventors to come in. And it was the man from Middletown (see "Engineering Magazine," November, 1899) who so nearly closed the door from 1871 to 1888. He never directly received to the amount of one cent from his invention which is so universally used on both automatic and hand screw machines. [What is referred to here are the inventions of Mr. Parkhurst himself, whose name is used to designate the wire feed for screw machines invented by him.—Ed.]

TURRET HEAD OF THE FITCH MACHINE.

The only distinctive feature of the Fitch machine here shown is the revolving turret (carrying cutting tools) mounted in a head. The self-revolving mechanism, which was totally unlike any in present use, is not shown. It was a complicated affair because of the attachment of a hand lever to the wedge cam for releasing the index catch, and revolving the turret by a pawl and ratchet disk.

I first saw the machine in 1852, again in 1870, the latter sight growing out of a controversy relating to the self-acting turret by the action of return movement of hand lever, which matter could not be satisfactorily settled without putting the machine in evidence. A special journey was made to Rockfall, Conn., the machine found in an attic; the silent witness told its own story about being self-acting. The gentleman who was my companion at that time is a very much alive and well known mechanical *savant*. The parties owning the machine would not sell, and it was destroyed by fire September 20, 1879.

The Billings turret here shown was designed in 1860. In general appearance it resembles the Colt machine, although embodying distinctive features added by Mr. Billings.

The Aston pistol shown is of the model of 1845, and the date on the lock plate is 1851. It is one from the last contract of 10,000. The cone in this pistol was made in the Fitch machine, and the pistol was presented to the writer by Captain Ralph Aston, U. S. N.

For the historical portion of this paper I am indebted to John North, the only surviving member of the Aston Company. Thanks are due also to C. E. Billings for assistance rendered and courtesies shown in connection with it.

Machining a Steam Cylinder.

BY B. W. T.

The cylinder of which this article will speak is a 10x12-inch, used on the frame the machining of which was described in issue No. 13. The operations required were as follows: Boring and counterboring the body of the cylinder, facing the end flanges, steam chest, steam and exhaust flanges, planing the valve seat, drilling and tapping the holes in all the flanges, boring and reaming the valve stem stuffing box, and drilling and tapping the stud holes for the valve stem gland.

Under the old method, boring and counterboring the body of the cylinder and facing the end flanges were done in a special cylinder boring machine. This machine was simply a horizontal boring mill, without the platen or any of the handy features of a modern tool. The boring bar had a cutter head, with provision for carrying two cutters, and it had also a facing head. There was likewise a facing head on the live spindle. Two chucks or standards, Fig. 1, were clamped to the bed of the machine, and in these the cylinders were placed and adjusted by the set screws. The same means of handling the cylinders were used as in handling the frame—the hand truck and chain lift. The strength of the gearing of this machine was not sufficient to drive a roughing cut with more than 1-32-inch feed, and at the same time drive one facing head.

It is hardly necessary to describe in detail the boring and facing of the piece, as everyone is familiar with work of this kind. It will suffice to say that owing to the lack of strength of drive and the instability of the machine, nearly every cut had to be made separately. It was thought necessary in making the finish cut in the bore to use a very fine feed and a scrape cut to secure a true and smooth surface.

Owing to the cored hole being eccentric or lumpy, two roughing cuts were frequently required. The average time consumed from the placing of the piece on the truck in the foundry until its removal from this boring mill was 4½ hours.

The next operation consisted in planing the steam chest, exhaust and steam flanges and the valve seat. An angle plate, similar to the one used in planing the frame, was used, its face being a fac simile of the end of the frame. The boss entered the counterbore of the cylinder, a clamp was placed across the other end and a bolt extended through the cylinder and angle plate, thus holding it firmly. By slackening the bolt the cylinder could be turned on the boss, thus allowing the steam chest flange, the valve seat, the steam and exhaust flanges to be successively brought into position. The planing usually required about 4 hours. The piece was then sent to the drill press.

The work here included all the drilling and tapping, also grinding the cylinder to the frame and the cover to the cylinder.

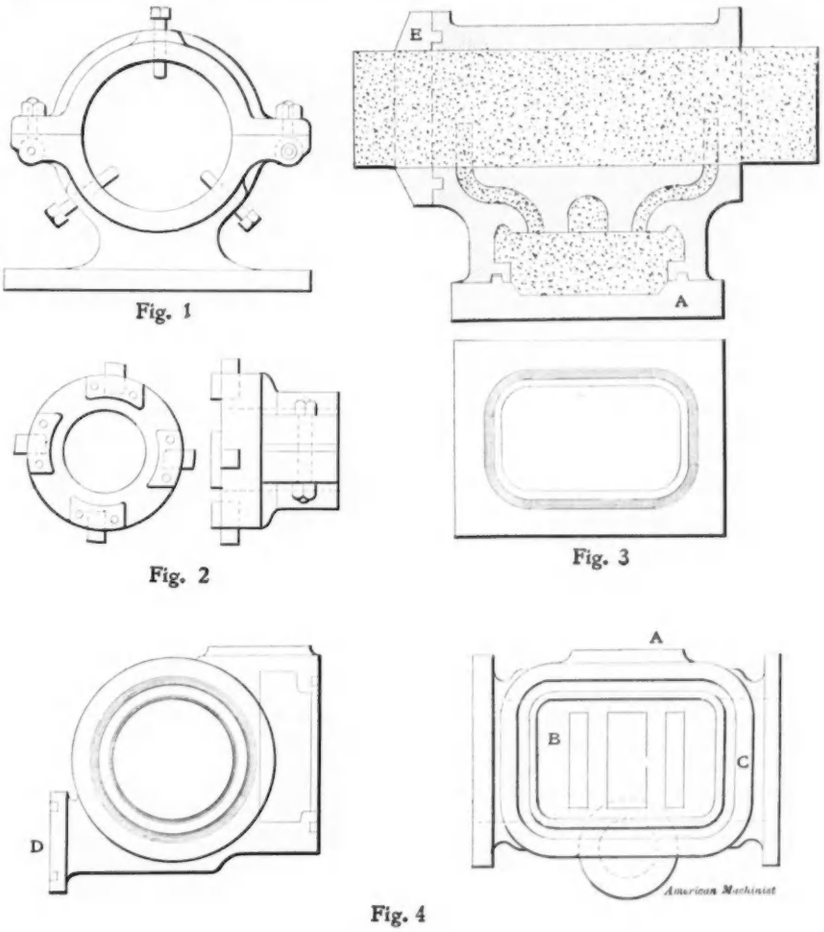


Fig. 1 Fig. 2 Fig. 3

Fig. 4

TIME SAVING DEVICES IN MACHINING A STEAM CYLINDER.

Grinding of the cylinder to the frame was done by hand power, the frame being set on end in a pit, the cylinder set in place upon it and turned back and forth by means of a lever bolted to the flange. Two men were required for this operation, which usually took about 1 hour. The grinding of the cover to the cylinder was done by power under the drill press, requiring about half an hour. The total time under the drill press, including drilling, tapping and grinding, was from 5½ to 6 hours. Thus the time on this piece from the foundry to the erecting floor was 13½ hours.

It will be seen by reference to Fig. 4 that there were four surfaces to plane—*A, B, C* and *D;* also two end flanges to face in the boring mill, two joints to grind and, to make up the complete cylinder, one steam chest cover to plane (or mill) and drill, and one cylinder cover to face and drill. The time above mentioned does not include the milling of the steam chest cover or drilling it, nor facing the cylinder head. These pieces were faced on both sides, and both were drilled. It took 3 hours to machine these pieces and the loose exhaust flange.

Facing of the steam chest flange of one cylinder and the exhaust flange were all done simply to secure steam-tight joints. Perfectly true faces were not absolutely necessary to insure a good working engine—steam-tight joints were all that was required. Fig. 3 shows how these surfaces were prepared for making joints that would not require repacking for a number of years. The chill *A,* with a projecting rib, a plan of which is shown, was placed in the mold, on which the steam chest pattern rested, the chill extending out beyond the flange forming the bottom of the mold. A ring chill was also provided, as shown at *E.* This, when setting the main core, was slipped over it and rested on the sand print. A similar ring was used to form the groove in the exhaust flange. These chills were all very carefully fitted and, in order to secure a perfect mold, the flask was made of iron, the joint planed and the ends bored to receive the main core. The core box was of iron; the joint was planed and the box bored, the core being baked in the box.

The steam chest cover, cylinder head and exhaust flange patterns were of aluminum, each having a projecting rib corresponding to the grooves in the flanges of the cylinder, the projecting ribs being slightly smaller than the grooves and ⅛ inch less in hight than the depth of the grooves. These patterns were carefully finished, having all the necessary stud holes in them. These holes were reamed with sufficient taper to allow the patterns to be drawn from the sand, leaving their own cores. Cylinders cast in this way came from the sand almost perfect, as did also the covers. To make the steam joints ordinary round packing was placed in the grooves and the covers drawn down, thus holding the packing in a pocket where it was undisturbed by the action of the steam.

By the adoption of this method the necessity of facing the steam chest flange, one end flange of the cylinder and the exhaust opening flange was avoided; also planing and drilling the steam chest cover and facing and drilling the cylinder head and the loose exhaust flange. Nor was the expense in the foundry increased; in fact, it was decreased by having perfect patterns and core boxes.

The casting, as now delivered to the boring mill, required in that tool the boring and counterboring of the body and the facing of one flange. To accomplish this, it was placed on the platen with the steam chest flange down, and between four chuck jaws, by which it could be adjusted parallel with the boring bar. When in proper position it was securely clamped to the platen by suitable bars and bolts. The boring bar was supplied with one cutter head, Fig. 2, which was secured in place by a taper pin, and in order to make it perfectly rigid the hub was split as shown, having a bolt with which to securely clamp it to the bar, thus preventing chatter. This head carried four cutters for the roughing cut. These cutters were of the best hard steel, one inch square, projecting beyond the head ⅝ inch. The pockets in which they were held were machined and the cutters ground in place. They were given but little clearance on the cutting face and the periphery, but were beveled back on what would be the top if used in a lathe, to give a shearing cut. The finish cut was made with one cutter, the counterbores with one. These were all of sufficient length to give proper diameter without the necessity, except at long intervals, of setting by caliper or gage. A tight-fitting screw with a slotted end was placed in the bottom of each pocket. When it became necessary to grind the cutters these screws were turned slightly outward, and the cutters then ground to size. The same facing head and cutters were used as on the frame for the rough cut on the flange; the cutter for the scrape cut being perfectly plain.

The operations were as follows:

The roughing cut was started with ⅛-inch feed, and when the hub of the cutter head was far enough forward to clear the facing arm, the roughing of the flange commenced. These cuts were both completed in from 10 to 12 minutes, and all the cutters removed. In order to make the counterbore on the outer end of the cylinder, the cutter was set with the cutting edge reversed and the back feed thrown in. This cut completed, the cutter was removed, the bar and head were run back and the other counterbore made. This cutter being removed, the finishing cutter was put in and the cut made with 3-16-inch feed. This being finished, the platen was moved forward, bringing the flange against the scrape cutter, thus finishing it. To set the cylinder and make the cuts as described required from 35 to 45 minutes, or an average of fifteen cylinders per day of 10 hours.

The work on the planer being reduced to planing the valve seat and the steam flange, the time was correspondingly reduced from 4 to 2 hours. By abolishing the grinding of the cylinder to the frame and the cylinder head to the cylinder the time under the drill press was reduced to 3½ hours. Thus we have the cylinder completed and ready for the erecting floor in 6¼ hours. By adding to the time required on the complete cylinder, as machined by the old method, the time necessary to face and drill the steam chest cover, cylinder head and loose exhaust flange we have 15½ hours, the improved methods resulting in a decrease of 9¼ hours on the complete cylinder.

These castings were all thoroughly pickled, and came from the foundry in the most perfect condition. This is not always the case, but a machine shop should never be obliged to contend with rough, poorly cleaned and chipped castings.

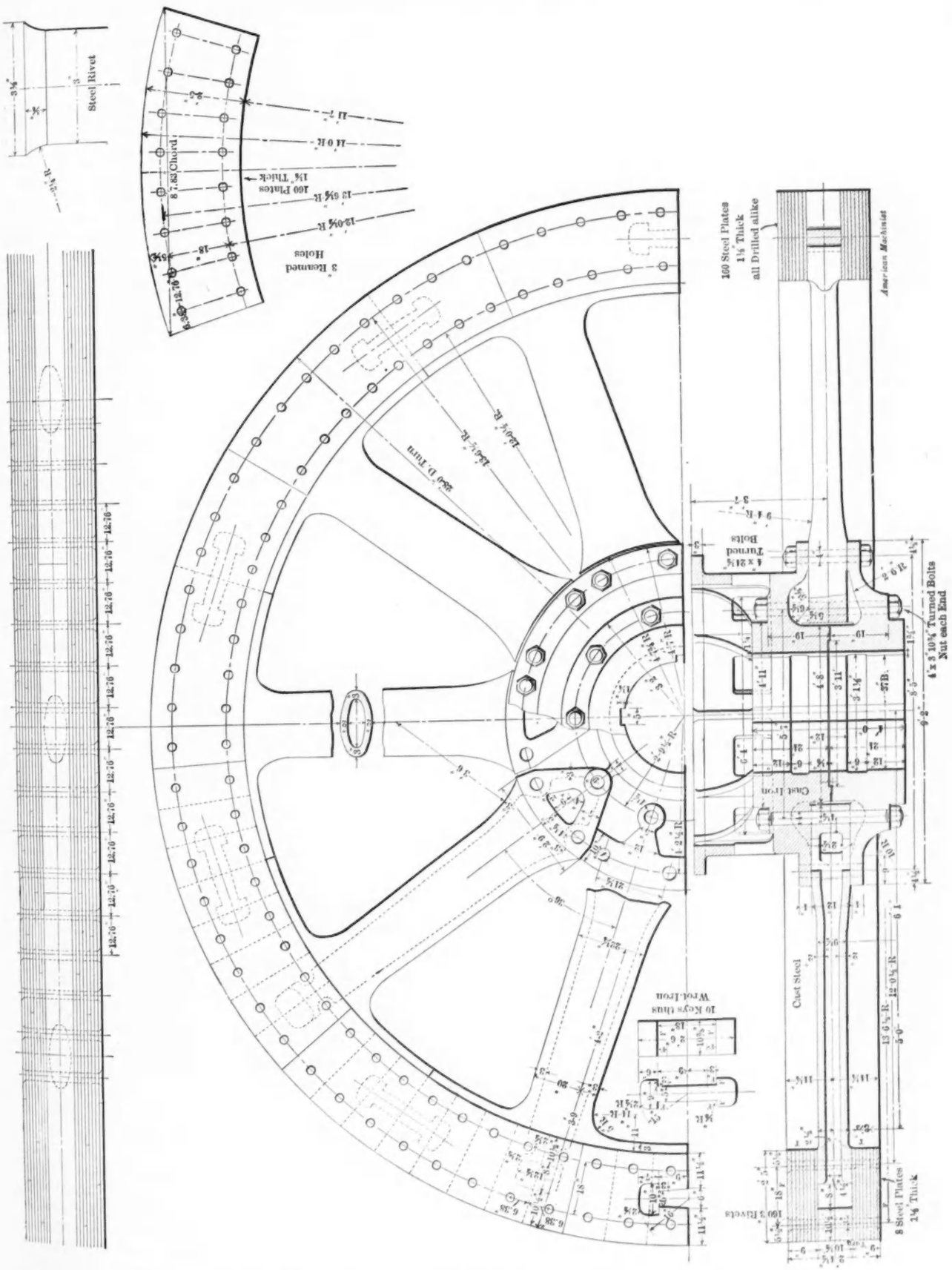
First-class cleaning machinery, pickling tubs, pneumatic chippers and improved handling devices, with ample room in which to work, will give better returns for the money invested than anything else around the factory.

Steel Flywheels for the Metropolitan Street Railway Company.

By the courtesy of the builders, the E. P. Allis Company, we are enabled to lay before our readers the accompanying valuable working drawing of the flywheels with which the great engines of the new power house of the Metropolitan Street Railway Company of this city are being equipped. A photograph of one of these wheels in process of construction was shown in our issue No. 19.

Except in its hub, the wheel is of steel throughout, and it will be seen to be of the highest order of construction in all that conduces to safety. The arms are hollow and most carefully proportioned, and the entire design is the result of the most careful study. Its most striking feature, and one which is, we believe, a novelty, lies in the reinforcing plates which are riveted to the sides of the rim casting. There are eight of these on each side, and the arrangement of the rivets will be seen to be such that the plates break joints with one another in such a manner that there are fourteen effective plates in the weakest sections. We do not know what the calculated efficiency of the entire joint is, but it is obviously high. The estimated weight of this whel is 310,000 pounds.

As the development of the Bessemer process involved mechanical problems of the highest order, so it has been with the electrical industry, and this wheel is a happy solution of one of them.


Steel Rivet
160 Plates 1⅝" Thick
3 Reamed Holes
160 Steel Plates 1¼" Thick all Drilled alike
4 x 2 1⁄16 Turned Holes
4 x 2 10⅛" Turned Bolts Nut each End
Cast Iron
Cast Steel
10 Keys Thus
Wrot. Iron
160 Rivets
8 Steel Plates 2¼" Thick

STEEL FLYWHEEL FOR THE METROPOLITAN STREET RAILWAY COMPANY.

An English Discussion of Tool Rooms.

At a recent meeting of the Manchester Association of Engineers a paper on "Tool Rooms" was read by Mr. Walter Heap. We reproduce from the "Iron and Coal Trades Review" a report of the paper and the discussion of it, which will be read with interest by American readers. It would have been scarcely possible to have had such a presentation of the subject and such a discussion of it in the United States within the past twenty-five years, as a tool room is now so universally a part of every machine-building plant.

"In giving his ideas as to what a tool room ought to be, Mr. Heap remarked that the tool room for the manufacturer would be larger than one for the general engineer. It should be equipped with a good sliding, surfacing and screw-cutting lathe, not less than 6-inch centers, 5-foot gap bed, fitted with a taper turning attachment, universal grinder, surface grinder, cutter grinder, universal milling machine, shaping machine, radial drilling machine, sensitive drill, tool grinder, twist-drill grinder and gas heating furnace. With these they could make all special taps, reamers, cutters, jigs, mandrels, etc. As to standard taps, cutters, reamers and mandrels, it would be cheaper and better to buy them from makers who had specially laid themselves out for manufacturing these articles in large quantities. The tool room should contain racks and pigeon holes for storing all the cutters, twist drills, flat drills, turning and planing tools, taps, stocks and dies, wrenches, hand drilling tackle, boring bars and cutters, and templates—in fact, all the loose tools used in the shop. Racks should also be provided for shop drawings. Several sets of all kinds of hand tools and tools for the machines should be kept in the tool room to prevent waiting, which meant loss to the firm. The foreman of the room should be a first-rate mechanic, able to design special tools and jigs, and he should have a draftsman in his office in the tool room to make drawings of jigs, etc., as they were required. The workmen should be smart men, who would take a deep interest in the work. An intelligent clerk, with a boy to assist him, would also be required. They would also require a laborer for the inside and one for the outside, the latter's duty being to go round to all the machines to collect tools that had to be reground. In his opinion no man on repetition work should be allowed to re-grind his own tools. All the tools stored in this department should be kept ready for earning money. As soon as tools were returned to the room they should be prepared for work again, and any damages repaired. In a manufacturing works he would allow no loose tools with the machines further than those which actually belonged to the machines. The tool room should be placed in the most central position of the works and be accessible from two sides if it were a large room. With regard to the tool room for the general engineer, this would not be equipped with the same machinery as that of the manufacturer, as the general engineer had not that amount of repetition work which would pay him to make jigs and keep such a large stock of gages, cutters and reamers. What he required was more of a store room for loose tools than a tool room, fitted with racks, pigeonholes, etc., for the reception of tools and drawings. If they had a fitter's bench, vise, surface plate of medium size, tool grinder, small cutter grinder and an ordinary grindstone or wet emery wheel, he thought these would about meet requirements. When new boring bars, boring heads and other tools used in a general engineer's shop required making, the machine tools in the shop should be used, and any fitting that was needed could be done by the tool stores fitter. They should also have in the stores room a set of standard cylindrical gages to cover the general work done in the shop, these gages to be kept for reference only. Other gages, made in the shop, should be used for general purposes. A standard steel rule, say 4 feet long, would be found very useful, also a 12-inch vernier to obtain correct measurements of odd sizes not included in the range of cylindrical gages. A hardened steel 18-inch standard square should not be omitted. A large assortment of twist drills could be bought of all sizes, rising by 1-64 inch; there was no necessity to use common drills for the odd sizes. He would suggest that no drills be kept at the drilling machines; when not in use they should be returned to the tool stores. The man in charge would regrind and put them in their own racks; he should be a good mechanic, with a youth to assist him. All flat drills must be kept in the stores. These should be properly made and kept up to size. Sets of turning and planing tools, made out of various sections of steel, suitable for the lathes and machines, should be kept in the stores always ground and ready for work, these to be supplied to the workmen and returned to the stores when the cutting edge was gone, and others given out. A laborer should be employed to act as tool carrier, and go around to all the machines collecting tools for repairs and re-grinding. He would suggest that a sample of each kind of tool in use should be kept in the tool room. These samples or patterns could be sent to the smith, so that he might forge new tools and repair old ones correctly. A good supply of bolts and clamps should be kept at the tool stores for use on the machines, each length and diameter of bolt being kept in separate racks. They should also keep good steel mandrels, hardened and ground, and planed cast-iron parallel packings in the tool stores. The man in charge ought to have instructions not to allow any tool to go out unless it were in a good and fit condition for its work.

"In course of a discussion on the paper, Mr. Constantine said, with regard to the tool room, if he were starting a works to-morrow it was one of the essentials to which he would pay most attention.

"Mr. John Royle remarked that it had always appeared to him that if they started a tool room in a works there was a great possibility of its not only attaining the end for which it was established, but also of its 'running to seed.' Another difficulty was that of keeping the man or men in it steadily employed, and it seemed to him that part of their time could be profitably occupied in not only keeping up tools, but making new ones, even twist drills, reamers, etc.

"Mr. Yates asked whether a tool room would be economical for a small works, in which there were about two dozen tools.

"Mr. Hunt said he had been in a works where there were less than two dozen tools, but which, nevertheless, had a small tool room in the gallery, which worked very successfully.

"Mr. G. Saxon said that, although perhaps most of them, if they were starting a new works, would make some provision for a tool room if they had the requisite capital, they would find a difficulty in starting a fully equipped tool room where their works were already established on a certain plan, and the men were accustomed to a certain routine.

"Mr. Boswell thought the system of the tool room might be carried too far.

"Mr. Vose thought a good tool-room system afforded a spur to effort and invention on the part of those who looked after the tools.

"Mr. Gunther observed that at his works, which was neither a large nor a small establishment, they had a fully equipped tool room, and found every advantage accruing from its use. As regards the cost, they had to make up their minds to a comparatively large initial expenditure, but he might say that their wages bill on a greater amount of work was practically the same, and on an equal amount of work was considerably less than it had been before they set up the tool room.

"Mr. Matthews said that where he served his time—Hawthorne's, of Newcastle—they had been carrying on a tool room successfully for quite thirty years. He thought a tool room was necessary both for large and small works, and for a large works a gage room was also desirable. He was also a strong advocate of the tool-holder system. The tool-room system was, on the face of it, bound to effect a saving.

"The president said he was at one time works manager at an establishment employing 800 hands. They determined to establish a tool room, and this was done between Saturday noon and Monday morning, without the men knowing anything about it, but he might add that they did not experience any difficulty so far as

the men were concerned. The system at that works had proved a great success.

"Mr. Heap, in briefly replying upon the discussion, strongly advocated the general adoption of tool rooms."

A New 14-inch Lathe.

The excellent photographs reproduced in the three half-tones give a clear idea of a 14-inch lathe of new design throughout, to which the attention of our readers is invited. A lathe of this size, so that it is first of all strong, rigid and accurate, should permit quick and easy handling and have a wide range of adaptability, characteristics which seem to be happily blended in the design before us. The bed of the lathe strikes the eye at once by its smooth simplicity. It is of tubular cross section and of great depth and width. The headstock and footstock are fitted to one bold V on the back of the bed and a flat bearing on the front. The carriage travels on a similar V at the front, with a flat bearing at the back. It may be noted that this arrangement was advocated by Prof. Sweet about twenty-five years ago. This construction permits a great strengthening of the cross-bridge of the carriage, a hitherto notoriously weak point in the design of lathes of this class. The headstock is secured by bolts tapped directly into the bed. The spindle boxes are large, the bearings of Babbitt metal being cast solid into the head, compressed, bored and hand-scraped to fit the ground spindle. Nothing but the Babbitt comes in contact with the spindle, and there are no extra joints to work loose or to promote chatter. There is a large hole through the spindle and the center fits the spindle itself, instead of in a taper socket, thus assuring its accuracy. Ample belt power is provided with five steps to the cone. The footstock is offset and so shaped that the compound rest may be set parallel to the bed and still permit the tool to operate on work of small diameter with practically no overhang. It has a large spindle and a long bearing on the bed, being clamped by an eccentric shaft and a hand lever at the back. It sets over for taper work.

The carriage is gibbed both front and rear with large and long bearings, which are oiled automatically. The apron is made double, with shafts of large diameter bearing at both ends. There is a power cross feed which, with the longitudinal feed, is operated by friction and worm gearing. The hardened worms run constantly in oil. The carriage can be clamped for cross-feed work. The feed is by a splined shaft driven by a belt and a two-stepped cone and gearing, which give six changes of feed without stopping. Automatic feed stops are readily and minutely adjusted to operate in either direction. The slide screws are all covered and provided with micrometer dials.

The lead screw is large, and has two long half-nuts operated by a cam. The range of threads that may be cut is from 2 to 92 to the inch. Translating gears, which are furnished to order, enable the same screw to cut metric pitches. The lathe is also made with a metric lead screw, when translating gears will enable it to cut to the inch standards.

The taper attachment, which is clearly shown in Figs. 2 and 3, is simple and of few working parts, and easily manipulated by the operator in front. The bar is graduated and provided with adjusting

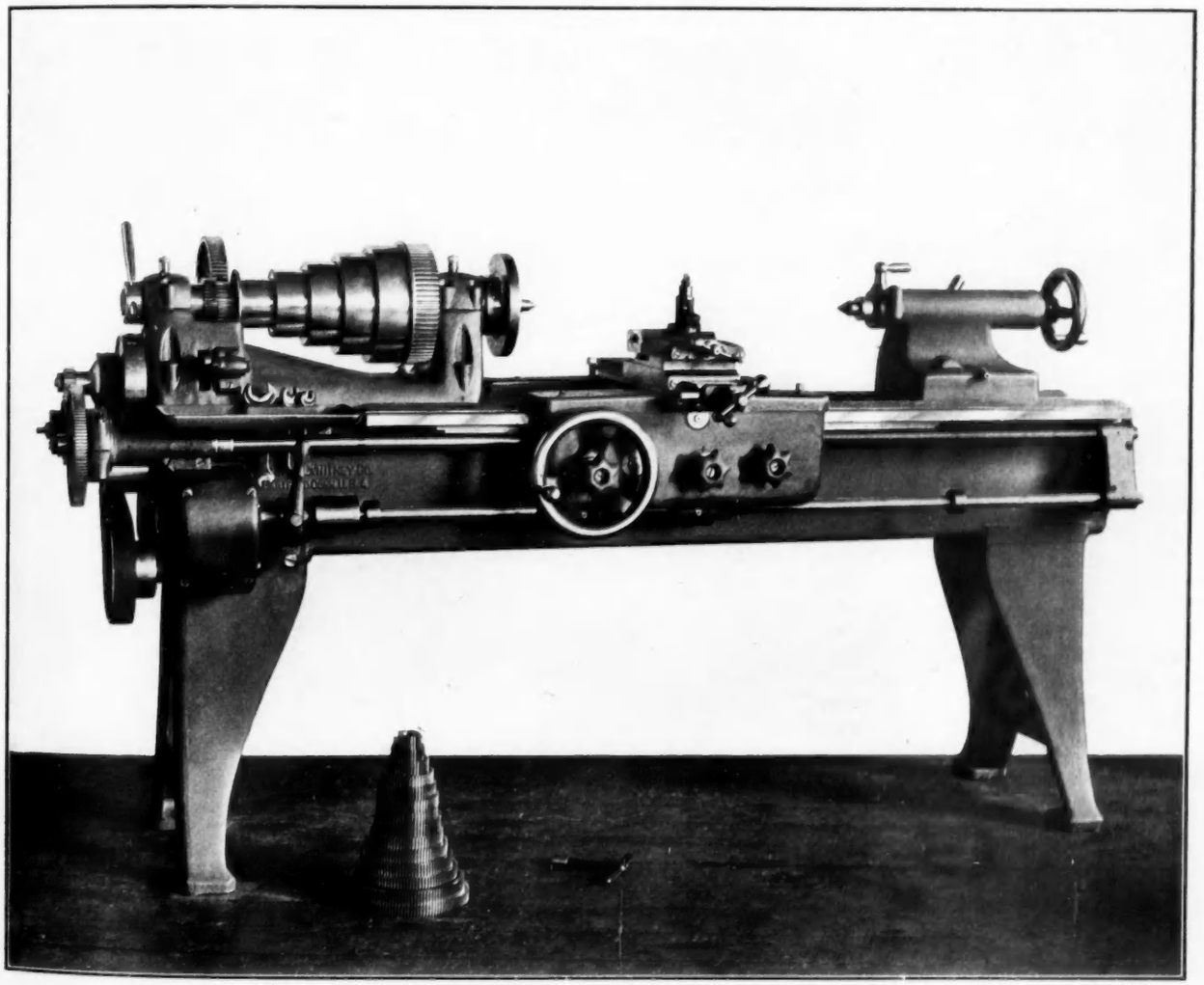


FIG. 1. A NEW 14-INCH LATHE.

screws for setting over. There is but one working joint with a taper gib to take up wear. There are no tipping tendencies. It is readily moved from end to end of the bed as required.

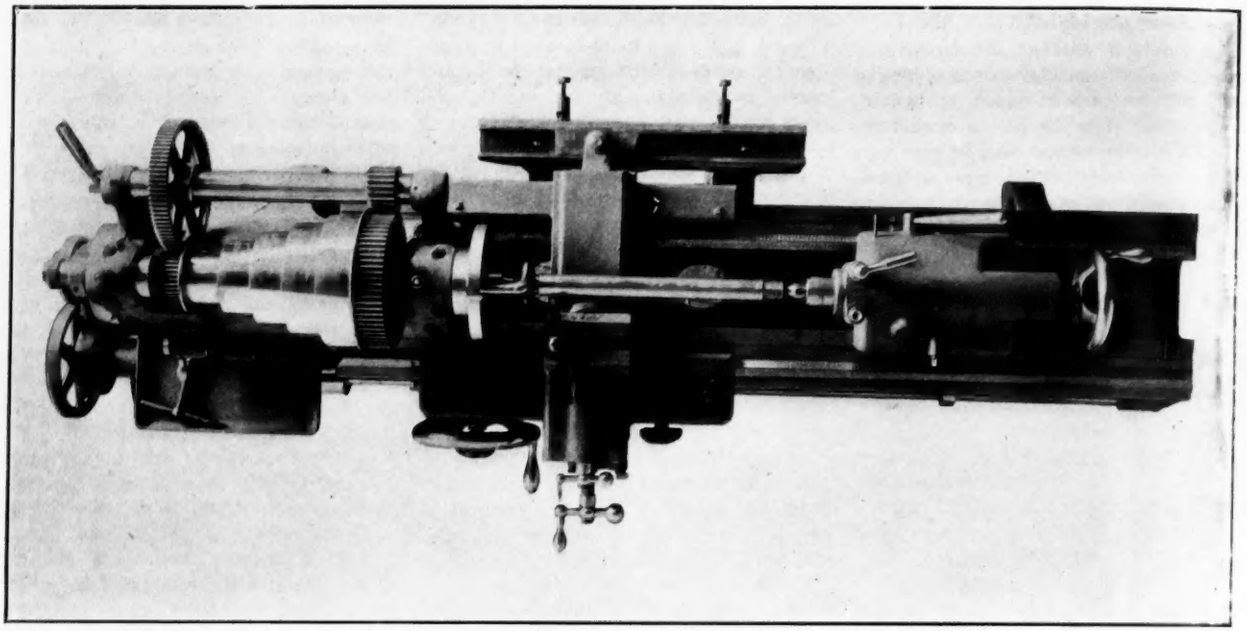


FIG. 2. TOP VIEW OR PLAN OF 14-INCH LATHE.

The tool pan and wrench rack will be noticed in front of the headstock. Large and small face plates, stationary and follow rests, wrenches, change gears and a double friction countershaft are provided. It is entirely unnecessary to speak of the materials or workmanship. Special attention has been given to the oiling and protection of every part. The following are some of the principal dimensions: Swing over bed, 15⅞ inches; swing over taper carriage, 9¾ inches; length of bed, 6 to 10 feet; greatest distance between centers, 6-foot bed, 36 inches; diameter of largest step of cone, 9 13-16 inches; width of belt, 2¼ inches; front bearing of spindle, 2 7-16 inches by 4 inches; hole through spindle, 1.3 inches; weight, with countershaft, 6-foot bed, 2,000 pounds. The lathe is built by the Pratt & Whitney Company, Hartford, Conn.

Conveniences for a Pattern Maker's Lathe.

BY A. F. B.

After many years of profitable reading of the "American Machinist," from the days of "Chordal" until now, my conscience has had an awakening, and I deem it my turn to contribute. My offering sets forth some of the attachments for a lathe which have fulfilled the exactions of economy in labor and material in a highly satisfactory manner ever since I had them made, a dozen years ago.

Boys, few men learn to turn well, and are prone to consider the lathe work a necessary evil, to be pushed through in a slipshod way with dull tools owned by everybody or nobody, while in reality the intensest mechanical satisfaction is in store for you if you will use your own tools and can get your foreman to provide the proper equipment. With your own tools in proper order you can produce good work, if there be nothing but a spindle to turn round, and, having exalted the work of the lathe, you may hope that fixtures to economize labor and material will have consideration.

Instead of the ordinary taper screw, which tries hard to split every piece, Fig. 1 shows a face-plate with a center boss (finished to size and true on its own spindle), which fits a hole bored in the block to be operated upon. This hole determines exactly where the center of the finished piece is to be, and it is very apparent that it can be returned to the lathe any number of times, or set over a pin the size of the boss, at any place, and always be concentric. The dotted lines of Fig. 1 serve to illustrate one of the most satisfactory operations on this simple fixture. The blank shown is finished on both sides with-

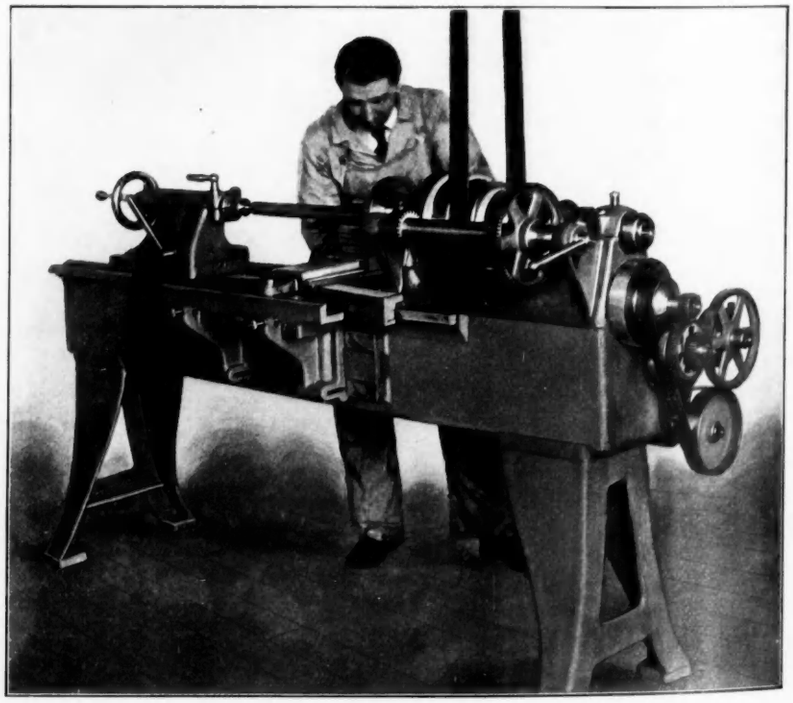


FIG. 3. BACK OF LATHE, SHOWING TAPER ATTACHMENT.

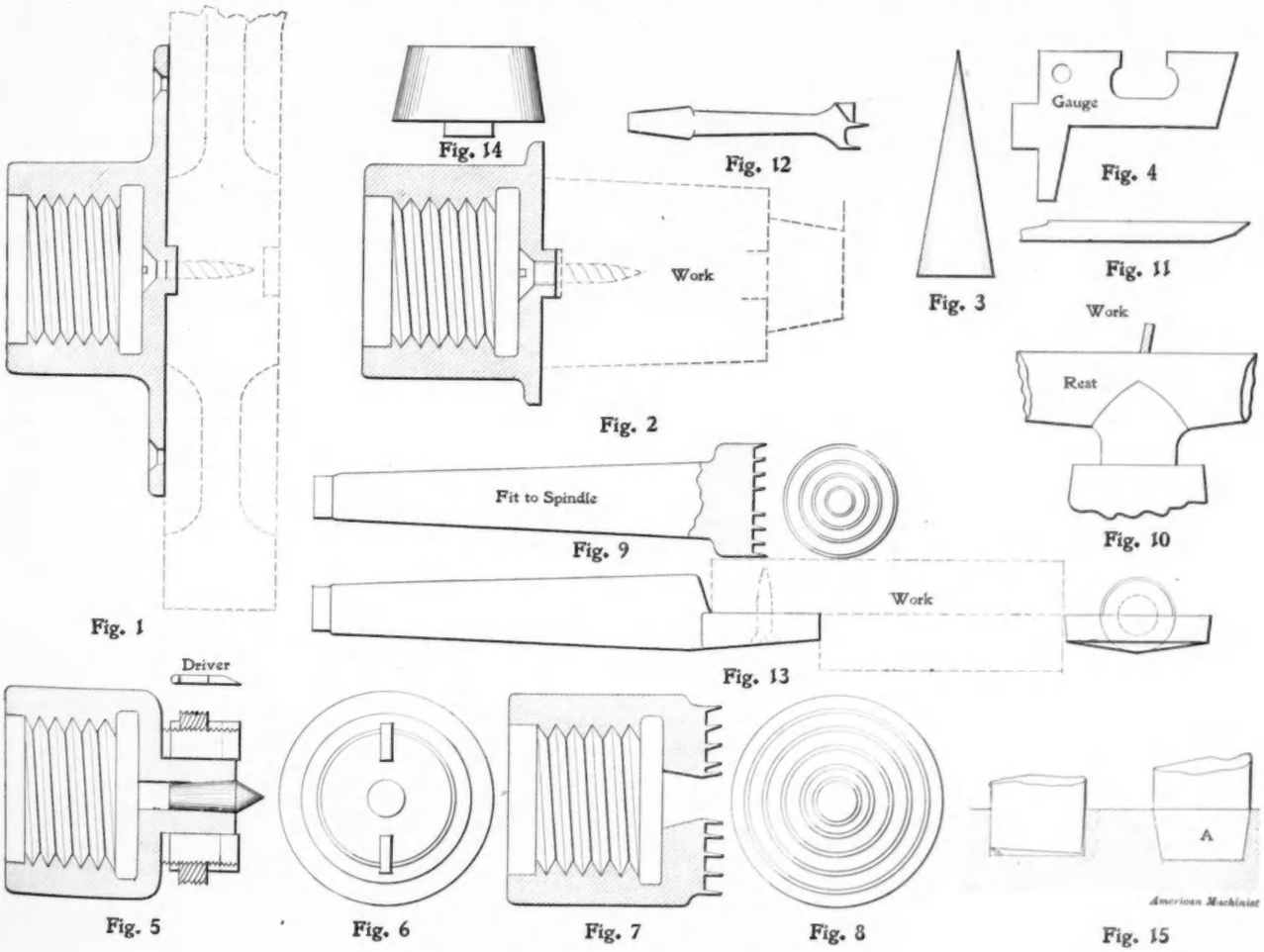
out any chucking and the attendant waste of lumber, time in looking up an old chuck that is "about right," and the fitting of the pattern into this chuck; all that is necessary after the one side is finished is to turn out a center hole into which the boss will fit, unscrew plate and work from the spindle, take out the center screw, reverse the work, reset the holding screw, and you are ready to complete the job without rooting around a pile of dirty old chucks. For large work screw holes are provided in the outer rim of the face plate, but it is amazing how the center screw alone will suffice, on account of the work being held "to center" by the boss.

Fig. 2 simply shows a flangeless chuck of the same kind, which will be found very convenient and light to handle. The boring of the holes to fit over the boss of the face-plate is a matter of prime importance, as there must be a fit or the "jig is up." For end wood use an auger bit, or a web-foot bit, and since these bits cut large, it is best to make the boss over size to suit a hole bored in end wood. For cross-grain the auger is not suitable, since it will not follow a center, and the web-foot is a nuisance, for it requires a circle to be laid out and then followed with more or less uncertainty.

The simplest and most workmanlike tool I have ever used is easily evolved out of the ordinary center bit by filing the center pin to a slim, tapered round, which will follow a center point perfectly and, with sharp cutting edges on the bit, leaves a round, smooth hole. Fig. 12 shows such a bit.

The multitude of conveniences and economies opened up by the interchangeability of turned work from this face-plate will be suggested at once to the mind of anyone having to do with pattern making and pattern changing. Hubs, bosses, core prints and such parts are quickly and accurately located, or can be returned to the lathe for alteration without loss of time.

The gage, Fig. 4, is simple to make, and if kept in one place around the lathe should insure duplicate work by all the men. The out and in diameter part of the gage will be understood to make fits for the center lug of the face-plate. The "drive chucks," Figs. 7, 8 and 9, are old, old affairs, coming to us, I am told, from the toy makers of the Old World. They fit the pattern makers' needs exactly, and I often wonder why they are not in use in all shops. A smart blow sticks a piece of pine to one of them in an instant, and short blocks, otherwise thrown away, are used up to the limit. In making this chuck turn the outside of the concentric rings straight, and put all the seizing taper inside. In this way no splitting occurs and the wood is sound nearly up to the rings. Do not have the rings scraped after turning, but leave the tool marks.



CONVENIENCES FOR A PATTERN MAKER'S LATHE.

In our work we use vertical cores tapered at both ends to facilitate the molder's work in setting. With a conical end at the bottom he drops the core to place quickly, without the danger of shaving one side down, like Fig. 15, and when the core comes to place it is snug like *A*.

A good standard for taper of a core cone is the one shown in Fig. 3, 1 inch base to 3 inches altitude, with the length of the cone equal to the diameter of the body of the core up to 1 inch, after which the length need not increase except for special cases.

Being dissatisfied with the uncertainty of getting split work divided on the center, I had the driver shown in Fig. 5 made, and have been pleased with its service. The first thing the driver gave me was an accurate 60-degree center, which, with a similar tail center, allows work to be reversed and run right. Next, it allows me to examine and correct my centers to the joint without having the driving blades to inter-

fere; fiinally, after I know I am right, to throw in the drivers by turning the collar while tapping lightly on the end of the work, to set the drivers without pushing too hard on the back center and loosening the front one.

Small, short split pieces are handily turned on a half holder like Fig. 13. This requires one-half to be left longer than the other for the fastening.

TOOLS FOR THE PATTERN MAKER'S LATHE.

At the outset I spoke of each workman having his own hand tools for the lathe. This is easily done at no great expense, since many of the short worn bench tools make good lathe tools, and old Grobet files are most excellent chisels. In turning a core print like Fig. 14, with the block stuck on a drive chuck, the end cut can be taken clean and smooth without danger of catching, if care is taken to keep the face of the chisels flat and the edges ground back, to present the tool to the work like Fig. 10. From this face use combination calipers to set off 1 inch as the length, cut down the taper to the gage, using it against the front surface, then run a narrow chisel down to the pin size as shown by the gage, pare the inside or bottom of the print same as the top, and cut off, leaving the pin as long as desired.

If your turning tools rub over on the edge too soon, get them hardened by the blacksmith, or, what is better, do it yourself. Grind with a long taper, and sharpen on a hard stone by holding high, and thus securing a short bevel and a well supported edge. Keep the upper face *flat*, and do not try to follow wood-turners' methods, with gouge and slicker, but a pattern maker's way, with gouges to rough out and straight, sharp chisels to finish accurately. Small work well turned requires nothing but No. O sandpaper to smooth up.

The Parallel Ruler Attachment.

BY WM. PILTON.

Concerning the interest shown in the parallel ruling attachments for drawing boards, I would say that about fifty of your readers, one from England, two from Canada, and the others from, it seems, almost every State in the Union, took advantage of my offer, in your issue of November 16, 1899, to send blueprint of details. Many applied for sets of castings, which were furnished them. The greater number included postage, a few forgot this, and a few sent postal card requests. I have also heard that the attachments have given entire satisfaction wherever used. The Long & Allstatter Company, of this city, have equipped their six drawing boards with them, and their chief draftsman, Mr. Faber, is highly pleased with the result obtained, and feels justified in abandoning his T-squares.

Acting on the information given by Mr. Oberlin Smith, in the issue of December 21, 1899, I have acquainted myself with Mr. Theodore Bergner's paper, which was read before the American Society of Mechanical Engineers at their fifth annual meeting, November 5, 1884, when he illustrated, by means of a model board and frame, his device of parallel ruler attachment. I feel that much that was said will at this time be of interest to many of your readers, and will therefore quote from said paper:

"As a test of the degree of accuracy obtainable by this device without special care, or even with such manipulation as would presumably tend to adverse results,

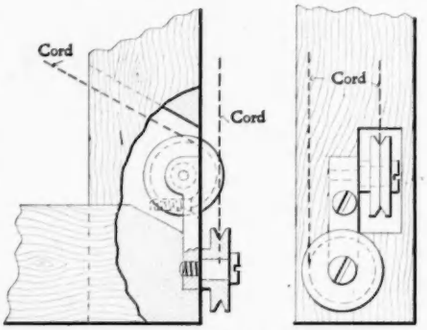


Fig. 1

two blank cards may be fastened at opposite ends of the board at hand, the endless cord of which is over 17 feet in length, and, as you will observe, of very moderate tension. If now a series of lines be drawn across these cards, these lines shall prove to be parallel, although I will, in moving the blade, alternately take hold of it at extreme ends (that is, having drawn a line, I will for the next line move the blade by its right end, then by its left end, and so change about for a series of lines). The true parallelism of these may now be observed by bringing the edges of the two cards together." (The ruled cards were taken from the board and produced for inspection.)

"To a feeling of security and full reliance upon the correct action of this ruler, which the draftsman soon experiences, comes that sense of ease with which he finds he can move his blade up and down, taking hold of it for that purpose at any most convenient point. It soon makes him forget that unceasing care with which his left hand always had to bear upon the blade, and at the same time press the head of his T-square against the guiding edge of the board, while his right hand was drawing the line along the blade, which he found more and more yielding and insecure the farther the work was from the head-block of his T-square."

A life-saving device. Quoting further from Mr. Bergner: "While I have no medals and diplomas from Humane Societies, attesting to the saving of the lives of any of my fellowmen, I am in possession of several very warm letters of thanks from persons whose health had been greatly impaired by persistent occupation at the drawing board, and who, with the change to a more healthful position, have experienced great relief and a return to normal strength and vigor."

In regard to wire *versus* cord to be used for this purpose, I might say that with some thirty of these attachments in daily use, 100 yards of good linen cord will make all repairs for several years. Mr. Bergner on the cord question says: "I will, however, add, that in my own experience and during several years of steady use of these boards in my offices, I have not only never had occasion to renew any of these cords, but have, on the contrary, found them rather to improve with time, inasmuch as they become 'set,' as it were, or more and more inelastic the longer they are in use."

Mr. Bergner originated and patented on April 18, 1871, nearly thirty years ago, his first attempt at a ruler attachment. Later he devised the endless cord over four grooved pulleys set in at the corner, as shown in my article, November 16, 1899 (Fig. 10), and still later the eight grooved pulleys applied to frames using several boards made to fit, a number of which were purchased for the drawing office of the Niles Tool Works Company, proving entirely satisfactory until the six grooved pulleys and cord crossed in the rear were introduced. Advantages of the latter are, less friction, the full length of cord in sight, and this other important factor, *i. e.*, ready means of removing the gummed oil and applying new. This, as the writer and

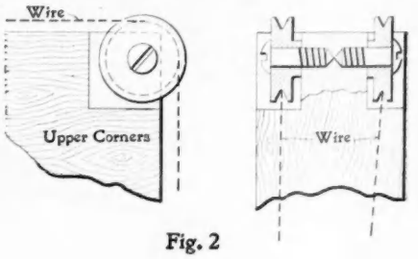


Fig. 2

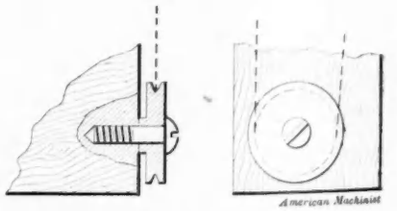
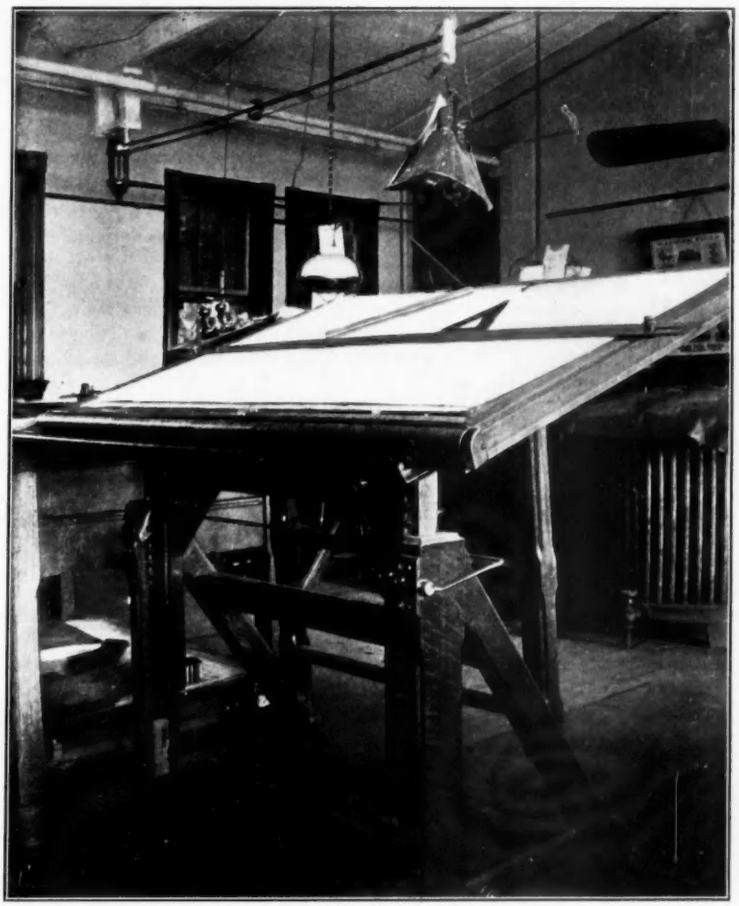


Fig. 3

many others can affirm, must receive attention once or twice a year. The cord pulley carriages for each corner in the Bergner were constructed as in Fig. 1, and to clean and oil them required their removal from the recess in the frame. After several such removals the wood screw holes, even in the hardwood frames, became enlarged. Figs. 2 and 3 show what I presume is the corner construction of the attachments as illustrated in "American Machinist," No. 14. I fear that such a construction would prove disappointing to any who should attempt to use it. Judging

from my own experience and observation, I would say that an efficient ruler attachment must embody the following conveniences: (1) quick adjustment at the end of the ruler for the purpose of taking up any slack in the cord. This, of course, has a tendency to put the ruler out of line with the work previously done, and requires another quick adjustment on the other end to bring the ruler to the line again. Both of these are accomplished in much less time than is required to read about them when using the means provided on the Bergner ruler or that of my description, November 16. (2) The sheaves must be so arranged that they will allow the greatest ease in operating the ruler at any point along its length. This is best accomplished when complete sheave corner frames are used, these frames being secured to the drawing board by wood screws. This construction gives a truer and more permanent alignment than could be expected of Figs. 2 and 3. The ease with which our 53-inch ruler can be operated is remarkable, since it requires only a light pressure of either thumb or forefinger of the left hand in the direction required. This brings to mind one other feature which adds value to this attachment, and that is the scale for measurements, when in use, is carried in the hand.

I have heard men say, "We make all our detail drawings on small sheets for shop use and use only a short T-square." Yes, so are all details at the Niles Works, as far as possible, made on 13x19¼ sheets, but we are enabled to work, quite advantageously, four such sheets at one time.



TILTING TABLE AND PARALLEL RULER ATTACHMENT IN USE AT NILES TOOL WORKS.

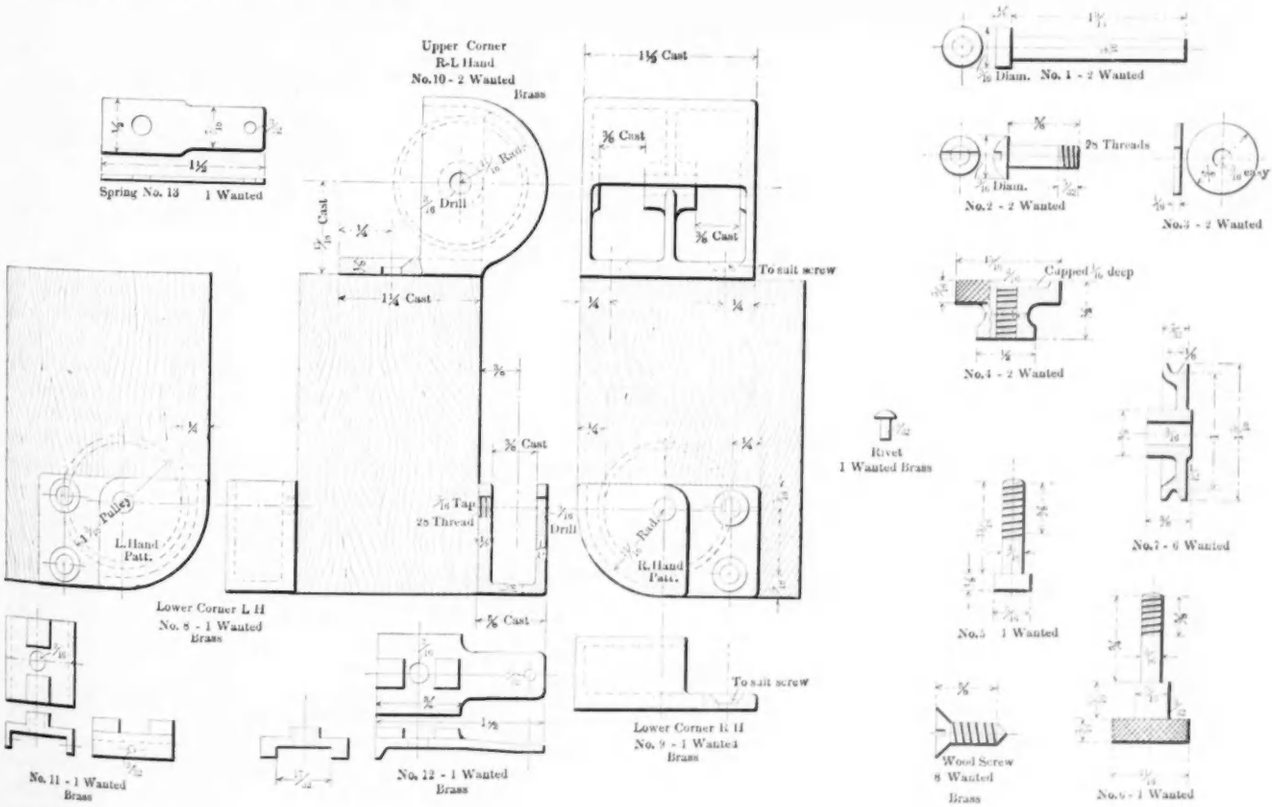


FIG. 4. DETAILS OF PARALLEL RULER ATTACHMENTS.

cutting apart when finished; that is, completing the pencil work on all before applying any ink.

It is safe to say that, when necessary—and there are such times—the parallel ruler attachment can cut the time on a drawing fully 25 per cent. over that of the T-square. Further, I cannot imagine a modern drawing room being completely equipped unless the men are provided with a good parallel ruler attachment and tables so arranged for tilting the boards to a more comfortable angle than that common to the requirements of a T-square, which is usually almost parallel with the floor.

I have noticed with interest the beautiful views of the Brown & Sharpe Manufacturing Company's drawing room, as presented in issue No. 10, also the view of the drawing room of the Gisholt Company in issue No. 15, and your readers, who know their construction, will perceive that all the draftsmen are provided with parallel ruler attachments, I would judge of the Bergner make, and a simple method of tilting the board. I do not see a T-square in use. Evidently Mr. Burlingame is not as adverse to its use as our friend Mr. Bell Crank, who states that he tried one for a year, and because of "swiping propensities," etc., "abandoned it." His " best substitute" for it, and his "perhaps a better plan" will require some investigation before adopting, and in the meantime, while waiting for "the one without such faults," which he promises himself to make and probably tell of to your readers, we will continue to use and improve the string parallel ruler attachment.

Fig. 4 is a drawing of details of the construction given in article of November 16, 1899. These are somewhat simplified, and any of your readers making the same will find them perhaps not perfect, but nearly enough so to give great satisfaction.

The photograph shows the type of tilting table referred to as being in use at the Niles Tool Works Company, and is considered a very good type of the same, being very quickly adjusted to any desired hight or angle. It also presents a good appearance.

A Process of Hardening Steel.

The following is the specification of a recent United States patent issued to a resident of Magdeburg, Germany. The practical value of it can, of course, only be ascertained by experiment, which, however, would not be costly or difficult:

"The piece or part of steel to be hardened is first coated with a protecting mass that is able to resist the heat of the fire in which the steel is heated, and thereafter cyanid of potassium is strewn upon that coating, whereupon the whole is put into the fire. The piece or part thus treated is then quenched. The object of the coating is to render the effect of the cyanid of potassium as uniform as possible, and I prefer to continue the application of the last-named substance after the steel, with its coating, is exposed to the fire; but instead of using only cyanid of potassium I use a mixture of this substance with coarse salt. By treating the steel in this manner I obtain in the same a very uniform structure which is not in the least changed when the steel is cooled down. This feature is particularly important in the case of machine parts and the like.

"The coating consists generally of purified chalk and varnish; but the chalk may well be replaced by clay, oxid of zinc, and other substances that do not burn down in the fire. The oxid of zinc may be mixed with file shavings of lead, when a solid crust will be obtained, resulting from the melting of the lead.

"When the steel to be hardened, after having been coated with the protecting mass, is heated, together with this mass, the varnish, that merely forms a kind of a cementing medium, burns and a hard porous cover remains. During the further heating of the steel with this hard porous cover the cyanid of potassium strewn upon that cover passes into and through the pores of the latter and distributes its action uniformly upon the surface of the steel, because the pores are uniformly distributed over and through the said hard cover formed by or resulting from the protecting mass.

"When using a mixture of cyanid of potassium and coarse salt, both substances are employed in pretty equal quantities, and the quantity of the whole mixture is, of course, dependent upon the size of the pieces or parts of steel to be hardened, or of the extension of the surfaces of same, respectively."

Purchase of the "Holland" by the Government.

The contract for the purchase of the submarine torpedo boat "Holland" provides for the delivery of the boat at the Washington Navy Yard with all its equipment and latest improvements up to date, and free of all liens and incumbrances. It also provides that the Government shall be released from demands of any nature whatever against the boat on account of the adoption of any patented invention, article or appliance that may have been used in its construction; that the former owners will, at their own expense, furnish for a reasonable length of time all the operators, machinists, etc., skilled in the working, adjustment and management of the "Holland's" various mechanisms, etc., and who can properly instruct a naval crew in those matters.

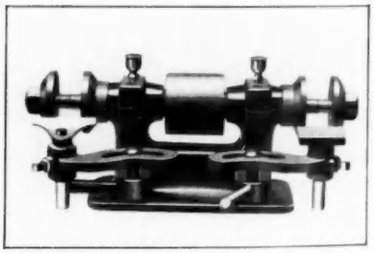
It is further provided that further boats of the same type may be ordered of the Holland Torpedo Boat Company at a price of $170,000 each, provided they comply with the specifications and requirements that have already been submitted to the Navy Department, but the department is not bound to place any further orders.

The price at which the present boat was purchased by the Government was $150,000. It is provided that if at any time the Government should decide to enter into the manufacture of such torpedo boats on its own account it can purchase from the company the rights, titles and interest to all patents applicable to the same that have already or may hereafter be issued by the United States, upon payment of a sum to be decided by a board consisting of three persons to be appointed by the Secretary of the Navy, two of whom should be naval officers, and the third to be the choice of the Holland Torpedo Boat Company, due allowance being made at the time of such decision for the fact that the United States Government shall have afforded facilities for the development of such inventions by the appropriation of money with which to build the "Plunger," and the purchase shall include only such patents as the Government might desire.

A. F. T.

Improved Emery Grinder.

The half-tone shows a convenient emery grinder for general use. It has a good steel arbor with ample bearings, well protected from dust and with good provision for lubrication. There is, in fact, little to be said about it, except to call attention to the novel and peculiar arrangement of the rests. Those who have had experience with the usual long straight



slot in the base of the rest know how often it is difficult, and more frequently impossible, to set the rest in precisely the desired position. It will be seen here that by the use of the circular slots it is always possible to swing the rest a considerable angle in either direction before striking the frame, so that the rest may be placed as desired, whether a large or a small wheel is in use. The rest may, of course, be revolved in the socket, and raised or lowered as required and secured in position by the set screw at the side. This grinder is made by the St. Louis Machine Tool Company, St. Louis, Mo.

The experiments upon the disposition of garbage in furnishing gas to generate power are said to be still in progress, and the details are being kept close; but it is stated on what seems good authority that important developments may be looked for within a year.

Letters from Practical Men

Some Salary Unexpected—An Ingenious Automatic Stop for a Hoist.

Editor American Machinist:

I have been entertained, as well as instructed, in reading the recent articles in your valuable paper on "The Salary Expected." Of course, we all expect a salary if we work for it, but sometimes the salary we expect turns out, when received, not to be the salary we expected, by reason of some misunderstanding, flaw in the contract, or our shortcomings, and frequently our recklessness, for if there is a job on earth that requires careful pursuit, aside from drying dynamite in a hot stove, it is that of mechanical draftsman.

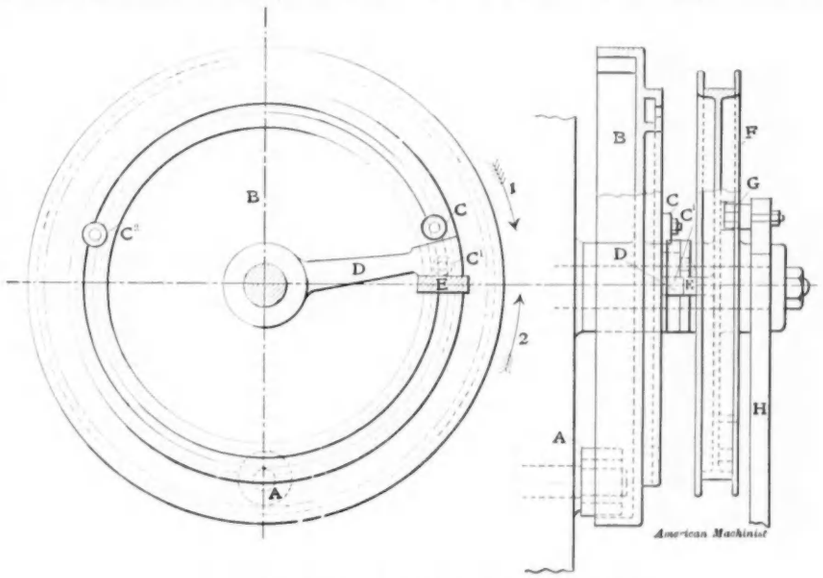
The salary expected is one of the hardest questions I was ever called upon to answer. I can easily say whether I can do this or that kind of work, but when the question, "How much salary do you expect?" sounds on my ears, I am stuck. "How much salary do you want?" would sound better as an open question. However, I have had very little to do with these questions and answers, consequently my practical experience in this line is limited to a very few cases, for with a few drifting exceptions for a short period of my life, I have changed but three times. My first and second jobs I held about nine years each, and I have held my present position over ten years, but I call to mind a time when I got a "salary unexpected." It was about in this wise:

I was in the employ of a company of elevator builders when they were building a large steam mine hoist for an iron company in Pennsylvania. The engine was about completed and set up ready for her various tests on Saturday, and before going home in the afternoon I took a parting look at her, for I expected she would be shipped on Monday before I could get another chance, but on Monday morning the foreman met me at the door and asked me if I had "made any calculations on the automatic stop for that large mine hoist," and when I told him I had not he said: "We are in the soup, for it won't answer. I wish you would try and see if you can't help us out of our difficulty, for I don't see anything to do but to make a new internal gear, which will take us at least a week, and we will be under a forfeit of $25 per day after to-day." I said "Gee whiz, let me get at it," for I am not a rapid thinker. Well, we both went and talked and thought, and thought and talked, shifted from one position to another, took off our hats, scratched our heads, looked at it from different points, and finally concluded we were doomed to pay $25 a day until a larger internal gear with about 175 teeth could be made and put on in place of the one with 144 teeth.

We parted. I went to my room; I could not give it up; I seemed rooted to it. I might have been there yet if a happy idea had not come in like a ray of sunlight in a dungeon, and the longer I looked at it the broader it got, until through the brilliancy thereof I could see my way clear to having that machine ready for shipment before night. I gave it one last and thorough investigation, to make sure there was no hitch, and then met the foreman and began to explain the rig to him. He interrupted me with "Oh, that's all right; don't waste time with me; here is the whole shop at your service, and me too, if you need me. Just go ahead; get it made and put it on, and then we will all be happy."

The accompanying sketch will explain the result, and probably be of use to a few of your many readers.

A is a pinion keyed to an extension of the shaft of the hoisting drum. *B* is an internal gear meshing with *A*. *C*, *C*¹ and *C*² are adjustable stop washers fastened to *B* as shown. *D* is a loose tongue swinging on the stationary pin that wheels *B* and *F* revolve on. *E* is a lug on the shifting, or starting and stopping, wheel *F*. *G* is a roller that rolls in a heart-shaped cam in wheel *F*. *H* is the link and rod connection to the throttle, reverse valve, brake, etc.



AN ADJUSTABLE AUTOMATIC STOP FOR HOISTS.

In the original makeup the loose tongue *D* was absent, and it was operated thus: The shifting wheel *F* was moved about one-quarter turn in the direction of dart 1, and the hoist started up the revolving gear *B* in the direction of dart 2, until stop washer *C*¹ came in contact with lug *E*, bringing it back to the position shown on sketch, and stopping the machine with the platform at the top of the lift; but in this case it stopped short, hence the trouble. In lowering, this operation was reversed.

The full capacity was obtained by cutting down the washer *C* and lug *E* until they would pass each other, cutting off the hubs of wheels *B* and *F*, and inserting the tongue *D* so that it formed a block between washers *C*¹ and lug *E*.

Now, we will suppose the machine has just been stopped in the position shown on sketch, with washer *C* against tongue *D*, which is against tongue *E*. The wheel *F* moves in the direction of dart 1, carrying the lug *E* with it one quarter turn. Stop C starts off in the direction of dart 2 until it passes lug *E*, picks up the tongue *D*, carrying it around nearly another turn before it brings up against the lug *E* and brings it back to the stopping position as shown on the sketch, nearly doubling its capacity, so that the washer *C*² was placed in about the position shown, thus cutting off the surplus reach, and the machine was shipped Monday P. M.

On the following Saturday I found an increase in my pay envelope. I took it as a thank offering from my boss, but it continued to come every Saturday, and in this way I got a "salary unexpected."

"Bow Pen."

Carnegie Profits, Small Shops and Shop Kinks.

Editor American Machinist:

The enormous profits made by the Carnegie Company seem to imply that it would be possible for them to drive all the small manufacturers of similar products out of the business, if they should decide to be satisfied with profits as moderate as the small manufacturer gets. It seems to me it would be interesting and instructive to know the causes which made such extraordinary profits possible. Clearly, it is not on account of having a monopoly of the source of raw materials, for they have never cornered the coal and iron ore supplies. Mr. Carnegie has given to the public some of his ideas of what is required to make a business successful. He claims the first requirement is "knowl-

edge of human nature. The test of a business man's ability is not what he does himself, but what he can get others to do in co-operation with him." "The greatest manager is the man who knows how to surround himself with men much abler than himself. He must love his work, and this will make his associates love it. He must trust and respect his associates, too, and that will make them trust and respect him." "I do not believe any one man can make a great success of a business nowadays. I am sure I never could have done so without my partners, of whom I had thirty-two, the brightest and cleverest young fellows in the world." "No man will make a great business who wants to do it all himself, or to get all the credit of doing it. The spirit is fatal and the sure proof of a small mind." "Nothing pays so well in business as generous treatment of employees. Indeed, the firm which sees that its men make the highest earnings is certain to be the most successful."

The Carnegie Company has not at all times nor under all circumstances followed this policy, but the general aim has been in that direction, and no doubt it has been the foundation of their success. All their chiefs of departments and ablest employees were made shareholders of the company, so they would have a deep personal interest in the success of the business. Their best employees were rapidly advanced to higher positions, and the incumbent president rose to the position from the ranks.

The manifestation of their policy has appeared in various ways. They have always aimed to have the best machinery it was possible to get or to make. They have often thrown out machinery which was better than that of nearly all their competitors, because they found they could get something more efficient. During the late hard times, when business was at its worst, they contracted for two new blooming mills and other machinery to replace inferior mills and prepare for the good times they were sure would come, fully appreciating that the right time to buy machinery and improve the equipment is when prices are lowest, and improvements can be made when orders are not crowding, with less disturbance and loss than at any other time. A careful examination of this policy shows that there is nothing about it which is not applicable to manufacturing on a much smaller scale, for the Carnegie Company is a growth from a comparatively small business.

Though there is almost no question of the great value of such a policy, it seems mighty hard to learn and practice in full faith, and there are not more than a dozen large manufacturing concerns in the United States who practice it sufficiently to make it visible to spectators.

I have noticed that many large machine shops which have grown up from a small beginning are run without any settled policy, and with no system or organization deserving the name, being, in fact, nothing but aggregations which are kept going by momentum gained in earlier days. No large manufacturing business can be permanently successful without a master mind who fully appreciates the worth of well paid and properly encouraged labor and the great value of the best machinery, and whose spirit permeates the whole organization.

A small shop could not compete with such an organization as that, and should not try to in any lines except that in which the chief value of the product is due to skilled workmanship. A small shop could make accurate surface plates, precision screws, fine index plates, or similar work, about as cheaply as any large concern, but it would not pay to build sewing machines or bicycles. In the more common lines of general machine work there is a great future for the well managed small shop. The great majority of medium size and larger shops are of the aggregation style, and no well managed small shop need fear their competition.

In the aggregation shop there is no just selection and encouragement of merit among employees; any suggestions made by them are either turned down or appropriated without credit, and wages are fixed by some arbitrary rule or personal bias, so that a good workman only stays until he can find a job elsewhere. There is no appreciation of the value of shop kinks, and there is an immense amount of lost motion and friction between the aggregate parts which is easily seen by a shrewd outside observer, but which apparently is invisible to the proprietors.

A small shop managed by a mechanic of good general intelligence could escape all such evils, and by making a specialty of something within the range of the capital at hand, could make a success of it.

This brings up what Mr. Armstrong has said about how few mechanics there are who will appreciate and put to use valuable shop kinks when made known to them. Mr. Armstrong is himself a proof of this, for a few weeks after writing the article he writes about belts, and advises making lathe cone belts narrower, and gives as a reason that it will prevent rubbing against the cone steps and turning the belt over, yet many years ago John Richards discovered a simple and cheap way of making the pulley to prevent this very thing, and it has been widely published in about all the mechanical papers, but Mr. Armstrong does not even mention it. I have made flanged pulleys that way with perfect success, and know it is a good thing.

The "American Machinist" of the past twenty years is a perfect mine of valuable kinks and plans for overcoming difficulties and reducing the cost of work, the like of which could not be found anywhere else. There are hundreds of these I would put in practice if I was in a position where I could do so, and it is in such things as this that the small shop could profit the most.

The ideal proprietor of a small shop would be a good mechanic, with a fairly varied experience as a shop hand up to a superintendent, with some office or business experience and somewhat of a judge of men. He should have not less than five thousand dollars capital, and a good character.

For a product a good patented specialty, if it can be had on a fair royalty, is a good thing, or the next best thing is to take some standard product, the cost of which is made up largely of skilled labor, and for which there is a fairly regular demand.

The skilled labor should be paid on the premium plan, so that the largest product may be had from the money invested in the shop, and more particularly to give the employees the same kind of incentive to do their best that the proprietor has.

A small shop run on this plan would avoid so many of the evils in the majority of large shops that it would more than compensate for the advantages which they have.

BELL CRANK.

A Milling Job—Backing-off a Counterbore in the Lathe.

Editor American Machinist:

Some time during the expiring years of the present century I was employed by the K—— Novelty Company (Limited), manufacturers of watches, projectiles, air castles, etc. The "limited" applied, among other things, to the machine shop equipment, which consisted of a good universal milling machine, a couple of lathes, a bad sensitive drill and an example of that class of tool grinders in which the front bearings run principally in air, and which produce an undulating surface on the work ground. The last two tools mentioned

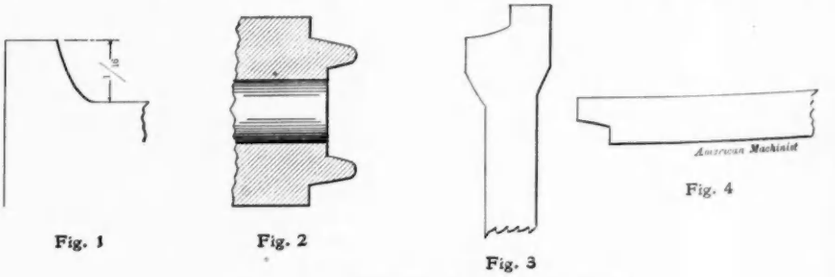


Fig. 1 Fig. 2 Fig. 3 Fig. 4

A MILLING JOB—BACKING-OFF A COUNTERBORE.

have no other part in this story than their moral effect.

There were required to be built some forming tools for the automatic screw machines—one a planed tool and the other a turret counterbore for end forming. The planed tool was to form a surface for thread cutting, and had a 1-16-inch projection, with an angle of about 30 degrees for recessing under a shoulder. There were no milling cutters nor ordinary means for this simple operation, so I was obliged to devise what appears to me a novel method for accomplishing the result. The work was placed in the milling machine vise, as for ordinary parallel cuts, the bed turned at an angle of 5 degrees, and the cut made with a narrow, square-faced mill. The result was a surface slightly concave, with a small fillet in the corner and approximately 30 degrees. The operation was simple and had the further merit of not requiring a readjustment of the work for the other operations. The cut Fig. 1 gives an idea of the surface enlarged ten times.

The angle to set the bed varies in relation to the diameter of the cutter and the depth of the cut.

The other tool—a four-lipped counterbore, Fig. 2—required to have its teeth "backed off" so that when sharpened its form would remain unchanged. Two tools were used for getting the form, one for the outside, the other for the inner surface (Figs. 3 and 4). After milling, the counterbore was back-rested in a ring, and the lathe was geared to cut a thread having a ratio to the lead screw of 3 to 4. The lathe used had a 6-pitch lead screw, and was geared for 4½ pitch. This arrangement allows a quadruple thread of 4½ pitch to be cut by simply moving the carriage back one thread on the lead screw for each of the four threads cut, and on this principle the teeth of the counterbore were relieved. The tool was adjusted so that when the carriage was fed to the work it would exactly meet the edge of one of the teeth, and the lathe was run at its slowest speed. The lead screw nut could be instantly released by a lever. When the cut on the first tooth was made the screw was released and the carriage moved back one thread without stopping the lathe, there being sufficient time as the next tooth cut was the one preceding the first, so that two teeth would pass the tool before the next cut engaged. Light cuts were taken and regulated by cross feed. The whole operation was finished in a very short time. Where a greater angle of clearance is wanted a ratio may be used of 1 to 4. The ratio of 1, 3, 5, or 7 to 8 may also be used for different angles of clearances, but when eighths are used care must be taken to skip two threads each time the carriage is moved. In a three-lipped counterbore the ratio is 1 or 2 to 3, or 1, 3, or 5 to 6. In sixths two threads must be skipped, as in eighths. Where they give clearance enough, the ratios 3 to 4 for four teeth and 2 to 3 for three teeth are the easiest and quickest operated.

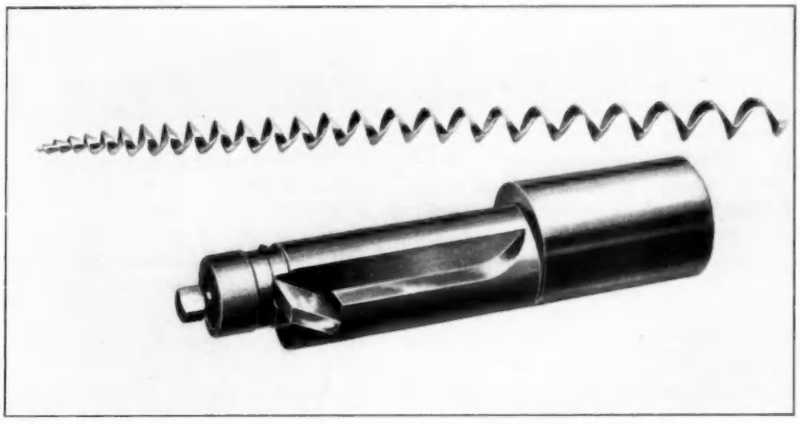
S. O. BARTLETT.

A Heavy Counterbore Chip, and the Tool That Made it.

Editor American Machinist:

I send you a photo of a large chip, and of the tool that made it. The photos were made separately, and at different focal distances, so that the appearance of each belies the other, and may be somewhat misleading. The total length of the tool is 8 inches, while the length of the chip is 3 feet. The cut was 11-16 inch wide and the feed 10 to the inch, the weight of this chip being 2 pounds. The work is first drilled for the end of the counterbore, and this end is hardened, so that it makes a good support for the back pressure against the cut. Otherwise I trust that the photos are self-explanatory.

H.



A HEAVY COUNTERBORE AND CHIP—NOT TO SOME SCALE (SEE LETTER).

Belleville Boilers.

Editor American Machinist:

I am interested in the letter of Mr. W. H. Booth in your issue No. 14, under the above heading as the first word of truth regarding the Belleville boiler which has come to us from England regarding actual practical trial. For about ten years I had to read in my London paper the booming and lying, with a few feeble protests from the more conservative engineers, culminating in the trial trips of the "Powerful" and "Terrible," which squelched all objectors and caused me to stop my paper.

Mr. Booth, however, and most other commentators against the Belleville boiler, as well as Belleville himself, continually miss the real points of objection in complaining only regarding the low angle of the inclination of the tubes over the fire.

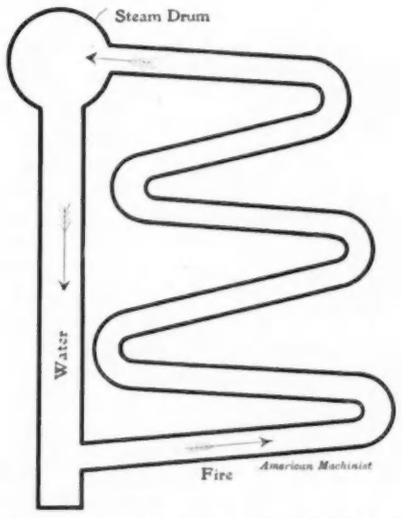
I enclose a very rough sketch of a vertical section, showing the fundamental idea of the boiler. All things else which Belleville has added in the last thirty-five years are inventions proposed for assisting in his fight against nature, trying to produce dry steam and to save from destruction the lower ranges of his tubes.

His very latest discovery is that the steam when generated in the bottom tubes does not know which way to go, and he has patented steel arrows, to be inserted as shown in my sketch, to point out the proper direction. Formerly they were only painted in and, of course, had no staying qualities, and it was noticed that when the tubes began to go the painted arrows had disappeared.

At one time a flap valve was put at the entrance of each bottom horizontal tube, opening inward, but it was found that the foot valve, as is often the case with automatics, did not know the proper time to automate.

A large cylindrical upright separator, standing in the fire room, was added to supplement the duty of the steam drum, then there were reheaters for the steam; it could stand a good deal of that after the chill in the outside separator.

The fuel economy was found to be poor,



SKETCH SHOWING WATER CIRCULATION IN BELLEVILLE BOILER.

so pre-heaters for the feed water were worked in above, and then "perfect combustion, wherein the hydro-carbons were to receive their proper measure of oxygen, by assistance of air compressors delivering

into the fireplaces at certain scientifically selected points."

The above in my quotation marks was about the way in which my London paper enthused; although it also said that there was very little smoke, except when new coal was put on the fire.

Another "automatic" was a float and lever connection at the water line level in the steam drum, which controlled the steam admission valve of a *"pompe de petit cheval"*—see Belleville's circulars—one for each boiler. This *"pompe"* was a crude, complicated attempt at reinventing the old, first and original Worthington donkey pump, from which the present generation of engineers is mercifully spared. There never was one that could continuously run for ten minutes, so that a man had to stand by constantly with the valve tripping lever in hand. Sometimes valve tripping was of no avail, and nothing would put her in motion but a blow from a light sledge in a tender place.

Coming back to the automatic action of the feed regulator float, and glancing at my sketch, it will be seen that it works precisely the wrong way, although it might do in a tank.

In this boiler when the fire is hottest the greatest amount of steam must be passing away, requiring the greatest speed for the donkey pump, but also when the fire is hottest the water in the steam drum stands at its highest level, tending to shut off the feed. The hight of water in the glass is no indication of the quantity in the boiler, so that with the best man tending water, the lower tubes must be burnt.

It seemed to me as if all England had gone crazy over automatics. Of course, there is an old saying that new fools are born every instant; but I had not looked for a whole generation to come in one instant in a country with the experience and literature of England, or else that all my years of observation and experience had gone for naught, consequently my relief at Mr. Booth's exposition, on which I will comment in a friendly way.

The insanity of England over its new boilers appears as nothing to what it was when they soon after began dancing to this tune:

"We all want to fight,
And, by jingo, if we do,
We've got the nobs and got the Bobs,
And got our Joseph, too."

Mr. Booth's complaint regarding the low angle of the tubes and the listing of ships gives but a small idea of the real fighting against nature which is carried on when the fire is burning under one of these boilers filled, or apparently filled, with water up to the nominal water line in the steam drum.

It is a natural operation for steam to be generated in great volume in the bottom tubes, causing them to be about empty of solid water while the upper ones may be partially or wholly filled, but weight and friction and the habit of following the line of least resistances to pressures are also properties of material things, so that the steam, instead of struggling up through ten or twenty lengths of pipe, no matter what their angle of inclination, escapes by its open end into the straight upright direct to the steam drum.

The upright pipe was intended to stand solid full of water for supplying the horizontal tube, but the real supply, that prevents it from being instantly melted, is what falls in backwards and by accident from the evaporating tubes above, and possibly from the stand pipe. With this intermittent and uncertain supply of water, it is no wonder that the operation of nature known as scaling or oxidation takes full effect upon the iron or soft steel tube, and it very soon splits from the internal pressure, escaping again by the direction of least resistance.

Soft steel tubes are, chemically considered, the purest iron, consequently very subject to oxidation.

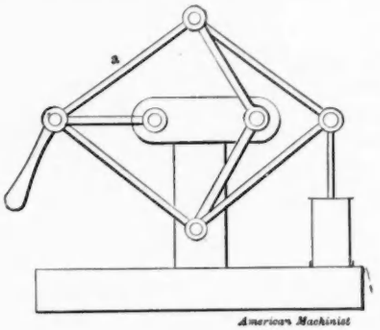
WILLIAM H. HARRISON.

Braintree, Mass.

A Straight Line Motion for a Hand Pump.

Editor American Machinist:

I enclose a little sketch of how one of the straight-line motions discussed in Prof. Peddle's paper, in your issue No.



11, that of his Fig. 4, might be applied to a common hand pump. The handle might be integral with member *a*, and might be made to point higher or at any angle most convenient.

H. W. POND.

Wrentham, Mass.

A Phenomenal "Inventor".

Editor American Machinist:

I enclose a clipping from a recent Chicago daily. It will go far to controvert the idea that all inventive talent is confined to the East:

"I wish to call the attention of the public that I have a patent bottle, and would sell the patent or supply anyone with the same; I got a valve that don't need any packing and a hanger that don't need to be greased only once a year, and can run 800 revolutions a minute, and a steel can be used for electricity or dynamos or anything without danger of burning, and it has a perpetual motion, and it can run a clock. Frank Faravella, 420 S. Clark street, Chicago, Ill."

A hanger that "can run 800 revolutions per minute" is certainly a novelty, and the fact that it "don't need to be greased but once a year," while many hangers within our cognizance get greased once a day, whether they need it or not, will appeal to the man who pays the "grease" bill. A steel that can "be used for anything without danger of burning" will be hailed with delight by tool-makers, even though it is complicated by the fact that it "has a perpetual motion and can run a clock." The attention of the Tripler Liquid Air Company is cheerfully directed thereto, or, rather, the buyers of liquid air and kindred stocks should have a "whack" at this.

W. R. M.

Use Tallow Instead of Oil in Making Plaster Casts from Wood Patterns.

Editor American Machinist:

Here is something that is well known in some shops, but for the pattern shops where they only use plaster of Paris occasionally it may prove useful. Instead of rubbing oil on the pattern, try tallow instead, and the result will be much more satisfactory. The former swells the wood and has a tendency to make the pattern stick to the plaster, often causing the corners to break off. Tallow does not soak into the wood, consequently the pattern will draw very nicely, and leave a smooth surface to the mold. C. C. R.

The Wage-Earners' Co-operative Hospital.

We have already mentioned the Wage-Earners' Emergency Hospital of Boston. The results of the first six months of its operation are so flattering that it is proposed to establish similar institutions in other cities, and Lowell has been selected as the first place in which to open a branch. The receipts during the last six months have been $32,444, and the expenditures (including $3,000 old debts, the hospital having been previously conducted by a different system) have been $29,479. The plan is said to be popular with the working men, as it is entirely free from any suggestion of charity. Card-holders, who pay $1 a year, are entitled to one year's hospital treatment free of charge. Only four out of a hundred require treatment.

Carl Hering, of Philadelphia, has been elected president of the American Institute of Electrical Enginers, which held its seventeenth general meeting in Philadelphia on May 16-18. There was a good attendance of active and associate members, representing the principal cities of the country.

(*Continued from page 486.*)

having an engine constructed which will be fitted with reheaters which will be so made as to act also as separators, the separators taking the water out of the steam before it reaches the reheating surfaces. In addition to this, the reheating surface will be on a very liberal scale.

Following this paper came one entitled:

The Gas Engine Hot Tube as an Ignition Timing Device.

BY WM. T. MAGRUDER.

Prof. Magruder in this paper gives an account of an extended series of tests of a gas engine with special reference to the time of ignition of the charge. The engine employed was of the four-cycle type, with cylinder 6 inches diameter and 12 inches stroke. No less than seventeen different particulars are enumerated as affecting the time of ignition, and, as far as possible, the tests were arranged for an investigation of the effect of each of these conditions separately. More than sixty indicator diagrams are given which clearly illustrate the lessons the paper is intended to enforce.

In the discussion one speaker raised the point that the hot tube must be so located that a good and uniform mixture reaches it. Another spoke of the faulty position of some electric igniters by which they become overheated and so act in the same manner as a hot tube. He had seen many such engines which would continue to run for this reason for some time after the electric current was cut off.

The next paper was entitled:

Water Softening Plant at the Lorain Steel Company's Blast Furnaces.

BY N. O. GOLDSMITH.

This paper first briefly discusses the methods of water softening by chemical means, based upon an exact knowledge of the character and quantity of the impurities, and then describes a carefully prepared and accurately and reliably working plant. The analysis of the water in its natural state is given and the cost of precipitating with different reagents. Four large settling tanks are used, with a capacity of 95,000 gallons each. These have mechanical stirrers, and here the precipitating chemicals are added to the water. The lime sludge precipitated is afterwards separated from the water by passing it through filter beds, and from there to the clear water well for use. The details of the plant are clearly described, and views of both the exterior and the interior are given.

In the discussion one speaker considered it advisable to conduct the reactions with the water to be treated at a higher temperature than that advocated, in order to save time, and hence reduce the size of the tanks.

Mr. Carey considered that we are in this country far behind Europeans in treating boiler waters before use. He compared chemical with mechanical treatment, and considered that sometimes one method and sometimes the other was preferable.

In his rejoinder the author condemned the use of small apparatus, saying that time is necessary for the reactions.

The concluding paper of the evening was entitled

Education of Machinists, Foremen and Mechanical Engineers.

BY M. P. HIGGINS.

This paper is the outgrowth of the discussion of the paper of the same title read by Mr. Higgins at the New York meeting last December, and published in full in our columns.

The first part of the paper may be described as a panegyric on the occupation of the machinist. Thus the author says: "It is quite evident that there is no general appreciation of the dignity and importance of the position of the mechanic. If I am able to express to you how I regard it, I hope to say that there is no occupation that is better fitted to develop character and elevate mankind than that of the mechanic. I am persuaded in my own mind, after years of thought and observation, that there are very sound reasons for assigning to the position and calling of the mechanic a certain elevation and superiority above that of any other profession. . . . So far as the kind of work affects the character of men, nothing in the line of human activity is so well calculated to develop the imagination in the direction of the creative powers of the human mind as the designing and making of machinery. . . . In the term mechanic I include all manufacturers, engineers and others engaged in the production of things useful."

Mr. Higgins then goes on to combat the idea that the introduction of automatic machinery has reduced the skill required on the part of the machinist, and in this portion of his paper he has largely reproduced his own ideas as published by us some months ago. He then discusses why it is that so few American boys are learning trades, and considers the objections offered by fond parents as either "imaginary or frivolous."

He then gives a few words regarding foreign trade schools, and proceeds to his main line of argument, in which he endeavors, and in our opinion successfully, to show that the difference between the machinist and the engineer is one of degree only, and not of kind. He instances some of the remarks made in the discussion of his previous paper by several teachers that took part in it, in which the idea that the education required for machinists and engineers differs radically in kind were advanced, or tacitly assumed, and proceeds to demolish the statements. He holds up his argument by paraphrasing Poor Richard's proverb about the pennies and the pounds in these words: "Look out for the American machinist* and the mechanical engineer will look out for himself."

In the course of his paper Mr. Higgins devotes a few words to the Russian, or exercise, system of shop instruction, as practiced in engineering schools, and finally, in conclusion, he discusses certain phases of his proposed half-time school which were raised in the discussion of his previous paper.

As was the case at the New York meeting last December, this paper was the most productive of discussion of any on the list. It is, moreover, to be noted that nearly all the remarks made were in entire sympathy with the paper. Here and there minor features were criticised, but as a whole the members present seemed to be a unit in their sympathy with Mr. Higgins. Mr. Kent remarked that he had no doubt that once the system obtained a start it would grow as rapidly as have technical education and manual training. The discussion was only terminated by the lateness of the hour.

THURSDAY MORNING SESSION.

This, the concluding session of the meeting, was opened with a paper on

The Automobile Wagon for Heavy Duty.

BY ARTHUR HERSCHMANN.

The beginning of this paper is given to a clear and fair discussion of the automobile problem, which, under the treatment of the author, leads inevitably to the steam propelled vehicle as the best as yet in sight for heavy trucking and all-round work, and he, who is consulting engineer to the Adams Express Company, then proceeds to give a description of a steam-propelled vehicle designed by him and built for the company. The details of the truck are discussed in an interesting manner, and the paper is an interesting and valuable one all through. The writer thoroughly believes in the automobile. He says that "if the motor wagon is given an unobstructed field and fair play, it will hold its own and oust the horse truck in short order. The change must come, and with, perhaps, the exception of the harness maker, everybody will benefit by it." Some interesting tables of comparative operating expenses of a two-horse wagon and a 3-ton automobile are given in an appendix, with other data of value to those who are struggling with this problem of the hour.

In discussing the paper, Mr. Mackie expressed the opinion that rubber tires are unsuited to heavy duty. He also expressed the opinion that wagons for heavy duty should be driven and steered by all four wheels, and sketched on the blackboard an arrangement of his own for this purpose.

Mr. Allison gave his experiences with gasoline and steam-driven pleasure car-

*We resent any imputation that there has been any collusion between Mr. Higgins and ourselves in this matter.—Ed.

riages, which were decidedly favorable to the latter, and the tenor of most of the remarks by others was that the steam engine was the preferable motor for the purpose. Its complexity was admitted, but its flexibility in the matters of effort, speed and reversibility were considered to more than offset this. One speaker, however, said that a gasoline engine is now made which is capable of being reversed and of having its speed changed, though he was not aware that it had been applied to a motor carriage. The failure of both electric and gasoline wagons to meet the conditions of Cincinnati, where hills abound within the city limits, was brought out by one speaker, who believed that a good steam carriage would have a large sale in that city.

Following this, the next three papers were read, with the announcement that they would be discussed together. The title of the first paper of the three was

Test of a 15-Million High Duty Pump Engine at Grand Rapids, Mich.

BY M. E. COOLEY, F. C. WAGNER AND J. R. ALLEN.

This paper reports a very extensive test, and with a fulness commensurate with the thoroughness of the test—the paper occupying 95 pages. The engine tested was a Nordberg triple expansion supplied with steam by Babcock & Wilcox boilers. The descriptions of the engine and boilers are very full, the leading dimensions of the auxiliary apparatus and machinery being given. The test occupied six complete days, or 144 hours, continuous running, with two additional supplementary tests of 12 hours each, made to determine the performance of the engines at half and three-quarter speed. The engines are notable in the matter of speed, which ranges between 38 and 42 revolutions per minute, with piston speeds between 310 and 336 feet per minute. The average duty for the six days' run was 12.735 pounds of steam per indicated horse-power per hour, and it is notable that even under the half-speed test the figure went up to only 13.897.

Indicator cards from the engine, as taken and also combined, are given with great profusion, as well as cards from the main, air and feed pumps, which are subjects of interest to those interested in indicator practice, but who have not had much opportunity for observing cards of this kind. There are also supplementary cards from the suction main, the air chambers, etc., and numerous data are given relating to the friction of the water valves as determined by indicator cards taken on both sides of them. The entire paper includes thirty-one tables, in which almost every item of interest connected with the performance of the engines seems to have been made the subject of investigation.

The second paper of the group related to a

Test of the Snow Pumping Engine at the Riverside Station of the Indianapolis Water Company.

BY W. F. M. GOSS.

This paper is the report of a test made December 3, 1898. A previous test, made July 3, 1898, had shown so high a duty that it was deemed wise to repeat it for the purpose of verification. The final test fully corroborated the results of the first and showed as a net result a duty of 147.5 million foot pounds of work per million British thermal units consumed. The result is higher than any which had been reported up to the time the test was made.

The delay in the publication of the report of the test sees these figures surpassed by other engines, but this does not change the fact that at the time the test was made the engine was a record breaker.

The last paper of the three was entitled

Pumping Engine Test With Superheated Steam.

BY E. H. FOSTER.

This paper gives the report of a test of a Worthington duplex low-duty engine, with and without superheated steam. The results of the test are given, and the author's main conclusions are as follows:

First—Steam, when superheated about 125 degrees Fahr., will do 16 per cent. more work than when saturated.

Second—With steam superheated as above and the feed water passed through an exhaust heater, a given amount of fuel will produce from 11 to 12 per cent. more work.

A printed discussion of Prof. Goss' paper by Mr. Heisler was distributed, but not read. It related to a new compensating device for direct-acting steam pumps, whereby they may be made to operate expansively and be compounded. A test of one of these pumps developing 9 horse-power showed a consumption of 52 pounds of water per hourly horse-power. The claim for the device is that it is so simple as to be applicable to small pumps as well as large.

Mr. Halsey remarked upon the emphasis laid upon the small engine friction of one of the engines tested, as shown by the indicator cards, and expressed the opinion that indicator tests for this purpose were of doubtful value. In the first place, the observer measured two large quantities in order to obtain their difference, so that relatively small errors in the cards would lead to relatively large errors in their difference. More than this, one indicator was hot and the other cold, which added to the probability of error. He was convinced that the inside of an indicator cylinder was no place for an indicator spring, but that it should be outside the barrel, where it would be subjected to constant temperature conditions.

The final paper of the meeting was on

Cylinder Proportions for Compound and Triple-Expansion Engines.

BY BURT C. HALL.

This paper opens with a statement of the controversy over cylinder proportions, which has grown up over the question whether there shall or shall not be terminal drop between the cylinders. The author believes that there should be such a drop, and presents his arguments in clear and forcible language. In his opinion there is no difference in the principle involved in deciding this question, as it applies to the different cylinders of a compound engine. In developing his argument the author points out that the reason for the use of drop in the terminal cylinder is to reduce the proportion of internal condensation compared with the total amount of steam used, and he says: "The condensation is not in proportion to the steam admitted and the work done, but is nearly a fixed amount per stroke for a given set of conditions. If more steam is admitted, the amount condensed is practically the same, but the proportion which is condensed becomes less; and for this reason it is economical to throw away some work by free expansion at each end of the stroke, for in so doing the total amount of work done per stroke is increased, and the condensation which is a total loss becomes a smaller proportion of the steam used." The author considers this argument equally applicable to all of the cylinders, and asks: "Why should we have drop at the release in one cylinder and not have it in another cylinder?" Indeed, in his opinion there is more reason for a drop in the high-pressure cylinder than in the low, which he states in these words: "There is another condition regarding drop in the high-pressure cylinder which does not exist in the low, and that is the improved condition of the steam due to the free expansion."

Another expression of his argument is offered in these words: "Some brilliant mind conceived the idea that by dividing the range of temperature between two or more cylinders condensation would be reduced. From that time to the present day the great object of engineers seems to have been to produce what is considered by them a perfect diagram, in which expansion is carried through successive cylinders without loss by free expansion. When it was found advantageous to divide the range of temperature into two or more stages, each successive cylinder should have been treated as an engine working between the two pressures assigned to it, and studied to get the greatest economy out of each cylinder."

At the conclusion of his paper the author refers to Mr. George I. Rockwood's well-known tests and his deductions therefrom. He does not agree with Mr. Rockwood that the triple expansion engine possesses no advantage over the compound on the score of economy, for the reason that the

engines compared in Mr. Rockwood's tests were a triple expansion without drop and a compound with drop, and he regards the presence of drop in the compound as the real reason why its performance rivaled that of the triple expansion engine. He asks: "If drop is advantageous, why should it not be equally efficient in the triple?" However, Mr. Rockwood's strong fight has been on the question of terminal drop, and in this the author agrees with him.

This paper brought out no discussion, due, no doubt, to the fact that the time for adjournment was already past.

Two topical discussions were then taken up, the first being on the subject

What Does it Cost to Run Trains at High Speed?

This topic was included in the program at the request of the Western Railway Club, which has discussed it at some length. A contribution to the discussion was submitted by Mr. Mattes, who considered that the abrasion of rails increased as fast as the square of the speed, or perhaps even faster.

The second topic was the

Protection of Penstocks From Corrosion.

On this topic Mr. Lewis related some valuable experience of his in the use of an English paint known as Bitumastic Enamel, which had been so successful that after being applied for six years the penstock was in as good condition as at first. He had had to deal with an old penstock which was badly fouled, and had succeeded in preserving it from further deterioration and had also increased its carrying power from 1,000 to 1,150 horsepower. He also knew of other penstocks to which it had been applied with entire success.

Other topics were on the program for discussion, but they were passed over.

This concluded the business of the meeting, but Mr. Rockwood brought up the old subject of the reading of papers by title only. There is an excellent provision in the rules which limits an author to the reading of an abstract of his paper, but this has gradually fallen into disuse, and at this meeting it was entirely abandoned, except in those cases in which the author was absent, when the secretary presented an abstract. It is to be presumed that through the distribution of advance copies of all papers those interested will have read them, and it is not to be supposed that those who are not especially interested in a given paper will be entertained by hearing it read at length, but nevertheless authors of papers with great unanimity inflict this reading upon the meetings, and thereby cut down the time available for discussion. The situation at this meeting developed into a real hardship, because of the hot weather. The secretary explained the efforts of the council to bring about a reform in this matter, but said that the attempt had been rendered futile by the feeling among authors that after going to the trouble of preparing papers for the benefit of the society, they were entitled to the privilege of reading them, even if no one wanted to hear them.

This closed the business of the meeting, and after the usual votes of thanks to those instrumental in carrying it through, it was adjourned.

Entertainments and Excursions.

This abstract should not close without reference to those features which, while outside the regular business of the society, nevertheless in point of fact are probably quite as much of an attraction in drawing attendance to the meetings as the formal business.

The entertainments and excursions were noteworthy from both the liberality with which they had been provided and the perfection of the arrangements for conducting them. Regarding this latter feature, much favorable comment was heard. There was never any uncertainty about what to do or where to go. The parties were properly chaperoned, and these things moved far more smoothly than is usual. A ladies' committee had been formed to conduct the visiting ladies to numerous points of interest during the sessions of the society, and the success of the idea was so great that it should become a permanent feature of the society's meetings. Among these excursions were those through the beautiful suburban portions of Cincinnati, to the Cincinnati Art Museum, and to the Rockwood Potteries. The first excursion of the society as a whole was down the Ohio River by the handsome steamer "Island Queen," to the plant of the United States Pipe Foundry, Wednesday afternoon. This gave many of the Eastern members their first opportunity for making the acquaintance of the Western river steamboat and its engines, as well as a chance to observe the highly interesting processes of a large pipe foundry. Thursday afternoon was devoted to an excursion to the plant of the Cincinnati Oyster and Fish Company as the guests of the Triumph Ice Machine Company, while Friday was devoted to a trip by special train to Dayton to view the plant of the National Cash Register Company. The many unique sociological features of these well-known works were explained in a lecture and the plant was viewed as fully as the time permitted. A feature of the arrangements for conducting the party through these works was so novel and worked so well that it deserves notice. A sufficient number of guides had been appointed to enable the party to be divided into squads of six or eight each. Each guide had a typewritten schedule of his route through the factory, but in *no two schedules was the order of visiting the various departments the same.* Consequently there was no confusion, crowding, or straggling, while every visitor had a guide within reach, of whom he could ask such questions as he desired. After viewing the factory the party was conducted to the women's dining room, where lunch was served and some appreciative speeches were made.

Nor should this article close without more than a mere mention of the reception of Thursday evening at the Hotel Alms, which was quite the most enjoyable event of the kind which the writer has seen at any meeting of the society. Among the causes for this were, first, plenty of room; second, excellent facilities for serving the supper (affording a marked contrast to those which we have growled at before this at Sherry's, in this city); third, excellent music, and fourth, a dancing floor which must be tried to be appreciated. This floor, by the way, is quite an engineering structure of itself, being supported throughout on springs, in which it is, we believe, unique.

The registered attendance at the meeting was 405.

Personal.

B. F. Jones, of the firm of Jones & Laughlin, and president of the American Iron and Steel Association, celebrated his golden wedding on May 21. He is said to be the oldest active iron manufacturer in Pittsburgh.

Henry D. Van Dorn, formerly draftsman for the Brown & Sharpe Manufacturing Company, but lately with the International Power Company, has resigned his position as draftsman with the last-named concern to accept the position of chief draftsman of the American Ship Windlass Company, all of Providence, R. I.

New Catalogs.

The Cleveland Punch & Shear Company, Cleveland, O., sends folder, of a catalog character, describing their radial drill adapted for use on bridge and architectural iron work, etc. Size, 6x9¼ inches.

We have received catalog with book of views of Purdue University, La Fayette, Ind. Courses of study are offered in mechanical and civil engineering and other scientific branches. Size, 5x7½ inches.

A catalog of the Rose Polytechnic Institute, Terre Haute, Ind., has been received. There are five parallel courses of study—mechanical, civil and electrical engineering, architecture and chemistry. Standard size, 6x9 inches.

The Norsk Bicyclefabrik, Christiania, Norway, send a catalog of the bicycles of their manufacture, containing also views of their works, outside and inside. It is printed in Scandinavian. Size 6¼x9½ inches.

Green, Tweed & Co., 17 Murray street, New York, send a catalog of the improved Rochester automatic lubricators for engines, pumps, etc. A list of interchangeable parts is included. The pamphlet is 5½x7¾ inches.

The Root & Vandervoort Engineering Company, Champaign, Ill., sends a catalog of its 10-inch speed lathes and of combination wheel and lever tail-stock, self-oiling countershaft, slide rest and other attachments. Size, 7x4¼ inches.

The Fort Wayne Electric Works (Incor-

porated), Fort Wayne, Ind., send Bulletin No. 1,008 of "Wood" generators, type "M. P." The sizes tabulated in this bulletin range from ¼ to 12 kilowatts capacity. It is 8x10½ inches.

"Air" is the title of a pamphlet issued by the Auto-Electric Air Pump Company, 39-41 Cortlandt street, New York. It describes this company's air pumps for use by physicians, dentists, artists, printers and others. Standard size, 6x9 inches.

D. J. Kelsey, 85 Cottage street, New Haven, Conn., manufacturer of draftsmen's specialties, sends a pamphlet showing chiefly a combination triangle, facilitating various operations in mechanical drawing. He is making a new ruling and erasing shield. Size of catalog, 3¼x6 inches.

The Wilbraham Baker Blower Company, Philadelphia, Pa., sends its illustrated catalog of the blowers which it manufactures under the Green patents. The points of these blowers are succinctly stated, and some practical hints for setting them up are given. Size, standard, 6x9 inches.

The Northern Engineering Works, Detroit, Mich., has published catalog No. 11, showing electric, pneumatic and hand cranes, of traveling, jib and other types. Air hoists are also here set forth. In a separate catalog are described their "Peerless" gas and gasoline engines. Each pamphlet is 6x9 inches, standard size.

The Bullock Electric Manufacturing Company, Cincinnati, O., sends us two new bulletins of the style which is in vogue among electric manufacturers. One of these, No. 34A, pertains to railway, light and power generators; the other, No. 36, to marine lighting and power sets. They are of standard catalog size, 6x9 inches.

The Stow Manufacturing Company, Binghamton, N. Y., sends a catalog of flexible shafts applicable to drills of different kinds, grinders and other tools. The company makes flexible shafts not alone, but drills, electric motors and many forms of special apparatus to be used in connection with the shafts. Size, standard, 6x9 inches.

The Whitcomb Manufacturing Company, Worcester, Mass., has issued a neat catalog of the metal planers it manufactures. These machines in regular order are illustrated in sizes from 17 to 48 inches. There are also shown the Whitcomb crank planer, improved planer centers and Prouty improved planer chuck. Standard size page, 9x6 inches.

The Massachusetts Institute of Technology sends us a copy of its catalog for 1899-1900. This old institution, with a faculty now numbering fifty-five, offers thirteen distinct four-year courses along engineering and scientific lines. A description of the courses in chemistry and chemical engineering has come in an independent pamphlet. Size of each, 5¾x9 inches.

The Windsor Machine Company, Windsor, Vt., has issued a catalog describing the turret machines which it manufactures. Here are found screw machines of several patterns, a special turret lathe, a number of monitor lathes, including universal, a brass finisher's lathe and chucking machines. These machines are shown in illustrations of a high order. Size, 6x9 inches, standard.

Gould & Eberhardt, Newark, N. J., send a catalog describing two "New Type" gear-cutting machines. One of these is the "Victoria," for spur gears 33x9 inches, and the other the "Altote," for spur gears 24x7 inches. They are made also in sizes 40x9 inches and 30x7 inches, respectively. The firm builds gear-cutting machines in eighteen different styles and sizes. The catalog is 9x6 inches, standard size.

The Cincinnati Milling Machine Company has gotten out a new catalog of its milling machines, plain and universal, which are described in detail and are illustrated on tinted plates. There are shown also various appliances, including special spiral cutting head, plain indexing centers, rack-cutting, high-speed milling, vertical spindle milling, universal milling, cam-cutting and rotary milling attachments, oil pump with tank, vises, arbors, tools, etc., and a new milling-machine dog. Size of catalog, 6x9 inches.

The Marshall & Huschart Machinery Company, of Chicago, Cleveland & Cincinnati, has issued a new catalog containing an assortment of high-grade machine tools of all kinds, many of which are newly added to the company's list. We note in particular not only that the company does not eliminate the manufacturers' names from the tools they illustrate, as is not infrequently done by dealers, but that they print the same conspicuously in the text. The catalog, which has a unique cover design, is 12x9 inches.

Manufacturers.

In our list of new corporations published in No. 17, the "Elmwood Lawn Mower Company, Elmwood, Ind., should have read "Elwood Lawn Mower Company, Elwood, Ind."

The factory of the National Meter Company, Brooklyn, N. Y., is being extended.

The Street Commissioners of Hagerstown, Md., are looking for a site for an electric power-house.

A power-house is to be erected at Belair, Md., for the use of the Belair & Havre de Grace Railroad, now being promoted.

A seven-story factory is being erected at 206-212 South Eleventh street, Philadelphia, Pa., for T. H. Miles, shoe manufacturer.

Armour & Co. have been granted a permit to erect a five-story brick factory at 1,041 Thirty-first place, Chicago, at a cost of $60,000.

A new machine shop and foundry will be

(*Continued on page* 45.)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 20.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Shaft'g straighteners. J.H.Wells,Tampa,Fla.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Wanted—A Whiton hand gear cutter, at once. The Sipp Electric & Machine Co., Paterson, N. J.

Wanted—To purchase, complete drawings for six sizes of dough mixers. Address Baker, AMERICAN MACHINIST.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—One pipe machine to thread pipe and casing from 8 in. down; Eaton & Cole machine preferred. Address "Pipe," AM. M.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Wanted, Immediately—Standard gage locomotive, weighing about 20 to 27 tons; state price, condition, location; must be cheap for cash. Room 723, Reaper Block, Chicago, Ill.

Wanted to Rent or Purchase—Modern building, in attractive location between New York and Washington, D. C., adapted for manufacture of light machinery. Box 34, AMERICAN MACHINIST.

For Sale—A double annealing and case-hardening furnace of Brown & Sharpe's latest pattern, in just as good order as when new; prices and terms very reasonable. Address Eclipse Bicycle Co., Elmira, N. Y.

Wanted—Horizontal boring machine with about 2½-inch cutter bar; standard make; state with description lowest price; also an automatic gear cutter for cutting internal teeth on wheels 14 in. in diameter. Address "Automobile," care AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wanted—Partner with capital; an experienced mechanic wishing to start foundry and machine shop, where free site and free fuel are offered as inducements to locate, desires correspondence with "broad-gage" man seeking profitable business. Address Box 35, AMERICAN MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Wanted—Position as foreman in pattern shop, by an experienced pattern-maker. Address "Pattern Maker," care AM. MACH.

Draftsman, 11 years' experience engine, gas engine and general work; technical graduate; good mathematician. "M.," AMER. MACH.

Mechanical and electrical designer and draftsman, practical and theoretical experience, wishes position. Box 41, AMER. MACH.

Blacksmith foreman, accustomed to large shop and good business methods; some knowledge of drop-forging; good education; good reasons for change. Box 40, AMER. MACH.

Foreman, 15 years' experience in general electrical and machine work, desires position; excellent references from past employers. Address "Foreman," care AMERICAN MACHINIST.

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